APPENDIX D

AN INVESTIGATION OF SOME PROBLEMS IN PREVENTING SEA-WATER INTRUSION BY CREATING A FRESH-WATER BARRIER

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AN INVESTIGATION OF SOME PROBLEMS IN PREVENTING SEA-WATER INTRUSION BY CREATING A FRESH-WATER BARRIER

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Water from the Metropolitan Water District and water from the Silverado aquifer were found to be compatible. Relative permeabilities of core samples from the aquifer were studied as MWD water was introduced into the core samples for extended periods of time. MWD water was used in five ways: with no addition, with de-aeration, with chlorine added, with hydrochloric acid added, and with acid and chlorine added. Bacteria, which appear to be either aerobic or facultative, were found in the aquifer.

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FOREWORD

The research described in this report, *An Investigation of Some Problems in Preventing Sea-Water Intrusion by Creating a Fresh-Water Barrier,* was conducted under the direct supervision and technical responsibility of Albert F. Bush in the Department of Engineering, University of California, Los Angeles. L. M. K. Boelter is Chairman of the Department.

The research was sponsored by the State of California Water Resources Board.

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INTRODUCTION

The establishment of a hydraulic barrier to prevent sea water intrusion is dependent upon maintaining the flow of water into the wells along the saline front. In the study of problems which might be associated with recharging of the aquifer the compatibility of the injection water and the permeability of the formation over a long period of time are important factors. It may prove beneficial to treat the water continuously or intermittently to maintain the performance.

In the coastal zone of the West Basin in Los Angeles, the Los Angeles County Flood Control District, with State Water Resources Board and District funds, are conducting experimental operations to prevent the infiltration of sea water. Metropolitan Water District water from the Colorado River is used as a supply during the experiment. The injection of fresh water into the closed Silverado formation in quantities which will push back or maintain the sea water requires injection wells spaced closely enough together so that the pressure mounds built up around adjacent wells will overlap. If this can be done, the barrier formed will be continuous, and will have a good chance of preventing salt water intrusion.

This barrier will be effective as long as the inflow is sufficient to maintain a continuous seaward hydraulic gradient. It is important to prevent permeability decreases in the formation close to the well casing after injection is started so that the extent of the mound around each well will not be decreased.

The purpose of the study was to determine whether MWD water was compatible with the water in the formation in the Manhattan Beach well field and to see what changes in permeability take place after a long period of percolation. The effect upon permeability of treating the injection water was also studied.

WELL FIELD

Though the work covered in this report was done in the Engineering laboratory on the Los Angeles Campus of the University of California, there is a direct connection with the field work being done at Manhattan Beach. Inasmuch as the core samples used came from these wells, a description of the well field is given.

A map of the well field is shown in Figure 1. The recharge wells lie between Manhattan Beach Blvd. in Manhattan Beach and Gould Lane in Hermosa Beach, a distance of about one mile parallel to the shore. Ten 12-inch injection wells have been sunk along the Santa Fe railway right-of-way parallel to and about 2,000 feet from the shore line. These wells are designated by letters ranging from C to K, with C being the most northerly. Eight of these are currently being used for injection. Thirty-six 8-inch observation wells are spaced at intervals away from the injection wells on both the seaward and landward sides, and are designated by numbers which increase with the distance from the recharge well. Odd numbers are seaward from the injection line while the even numbers are inland. The area covered by observation wells is from the injection line seaward 2,000 feet to the ocean and landward about 3,500 feet. Seventeen 2-inch observation wells were drilled along the line. Some previously existing wells farther inland are also shown on Figure 1. Four 4-inch observation wells have recently been drilled along the line and are not included in Figure 1.

During well drilling, samples of the Silverado formation were collected and brought to the Laboratory for study; samples of the water from the formation were also collected for analysis. "Undisturbed core" samples were obtained during the drilling operations with a sampling tube which produced a specimen about 2-3/8 inches in diameter and 6 inches long. Core samples were taken from the zone most likely to be used for injection and were selected by a field geologist as the wells were being drilled. Bulk samples of the sand and gravel from the formation were also obtained directly from the bailer while drilling was in progress. Tests in the field on water from wells numbered E-4 and I-1 showed no dissolved oxygen and carbon-dioxide, indicating an anaerobic environment in the aquifer. (See Table 1).

WATER SUPPLY

The initial water to be used for injection at Manhattan Beach is Metropolitan Water District (MWD) water from the Colorado River which has been treated at the Lime and/or Zeolite Softening and Filtration Plant located at LaVerne, California. Following treatment this water passes through about fifty miles of concrete and steel transmission lines before it reaches the site for injection. To make the laboratory tests comparable to the present field activity, water for laboratory tests was secured from the MWD distribution line at the Bundy Street plant in Santa Monica. From here this water was transported to the University by truck in a galvanized steel tank. The treatment process used at the LaVerne Plant is now predominantly zeolite but on some occasions lime and/or alum are added to remove turbidity. During the course of these tests lime and alum treatment has been used for periods of short duration and not sufficient in amount to change appreciably the quality of the water. In addition to softening, the water is chlorinated with approximately three parts per million of chlorine which gives a residual of about 0.25 ppm at the end of the ten-foot diameter distribution line in Eagle Rock. Dissolved oxygen measured at the point of delivery in Santa Monica has been found to be normally within 1 ppm of the saturation value corresponding to the water temperature.

LABORATORY FACILITIES

Twelve permeameters of the design shown in Figure 2 were set up in the laboratory. They were connected, as shown in Figure 3, in four groups of four. Group I was supplied with MWD water. Group II was supplied with MWD water but with chlorine added. The intention was to maintain a residual of about 5 ppm Cl_2, but due to the difficulty of metering the exceedingly small flows involved, the residual concentration varied from 0 to 40, with the usual value being around 5 ppm. Group III was likewise supplied with MWD water, but with hydrochloric acid added. The intention was to maintain the pH at 5.5 (the MWD water has a pH of about 8.2 to 8.5), but difficulties similar to those encountered with the chlorine system led to fluctuations between 8.5 and 3.5, with most values being between 5.0 and 6.0. After the first run of about 1600 hours the cores in Group II were removed and Group IV was installed which was run with filtered-deaerated water. Also after the first run, Group I was run with untreated water and later with acid plus chlorine treated water.

The permeameters were designed to hold core samples which were taken from the test wells and furnished to the laboratory during drilling operations by the Manhattan Beach project. The core samples were sealed in paraffin immediately on removal from the well and remained that way until they were put into the permeameters for the test.

Provisions were made for measuring the differential pressure across each permeameter and the flow through each permeameter, along with the temperature, pH, conductivity, and chlorine residual of the effluent water.

To deaerate the water two different methods were tried. The first was to boil for ten minutes then to condense and cool the water. The test apparatus (reference 1) for deaeration by boiling is shown in Figure 6.

The second method, which seemed to be more applicable for field use, was to subject the water to 29 inches of Hg vacuum while it was passing through the small capillaries of a filter. The system used for this type of deaeration is shown in Figure 6. The wiring diagram, which shows the controls for operation of the system, is shown in Figure 5. A more detailed description of the vacuum deaeration system will be found in the appendix. Preliminary tests by Lewis (reference 1) yielded the data for vacuum deaeration and aeration rates shown in Figures 17 and 18. His apparatus is shown in Figure 16.

LABORATORY TESTS AND RESULTS

Chemical and Physical Properties of the Water

Chemical determinations have been made on three water samples for the purpose of making ion balances and measuring pH and conductivity. The results of these tests are shown in Table 1.

Compatibility of Waters

To determine whether incompatibility existed between the MWD water and the water from the formation, tests were made using a variety of mixtures ranging from 5% to 95% MWD water. There was no evidence of flocculation or precipitation nor any noticeable deposits in the short test period.

Bacteria in Silverado Formation

Undisturbed core samples from the formation which were dissected in the laboratory under sterile conditions and plated on to petri-dishes of nutrient-agar showed considerable growth after 24 hours of incubation at 20° C. This seems to indicate that samples collected from the formation do contain dormant aerobic or facultative bacteria which will develop under aerobic conditions when nutrient materials are present. To determine whether bacteria are present in the bulk sample from well and in the water taken from the formation as well as the water used for injection, nutrient agar plates were used and incubated at 20° C for 24 to 48 hours. The results of this test show bacteria to be present in all samples taken from the formation and from the water as seen in the following table.

Sample	Bacterial growth on nutrient agar
MWD water	Slight
Water through disturbed sample	Some
Water through A-14 core	Some
Disturbed bulk sample from well	Considerable
Core I-1 141 ft. depth	Some (after being removed from permeameter)
Core C-8 260 ft. depth	Some (after being removed from permeameter)
Core C-9 115 ft. depth	Considerable (as removed from formation)

Samples from water in this test were prepared by plating out one-tenth cubic centimeter of liquid on the agar plates. For samples from the cores, about 1 gram of the material was transferred to a 50 cc portion of sterile water which was shaken vigorously and then a small amount of solution was transferred to the agar plate.

No attempt has been made to specifically identify these organisms though they appear to be Bacillus Subtilis and reptomyces species, the types commonly found in air, soil and water. No tests were made for specific slime producing bacteria. The mere demonstration of the presence of aerobic or facultative bacteria seemed sufficient to indicate the need for treatment of the water to control the growth and prevent the plugging of the well or aquifer.

Permeability of Core Samples

A list of the core samples tested is given in Table 2. An attempt was made to test in each of the four groups a selection of samples representative of the entire well field.

Data on the individual core samples are presented in Tables 3 to 20. As each core sample was put on the line, the permeability was measured several times during the first hour of operation, and then at progressively longer intervals as the permeability stabilized. Tests were operated continuously except for occasional outages. The vertical arrows on the curves indicate the outages. The extent of outages can be found on the data sheets. In reporting the data, the accumulated time is actual flow time (total time less outages). In four cases, permeabilities turned out to be so low that the tests were discontinued in a few days, when it became clear that there would be no improvement in percolation. When these cores were removed, they showed heavy cross-sections of impermeable clay which would account for the lack of flow. For the remainder of the cores, the accumulated time ranged between 500 and 5,000 hours.

The results are presented in two ways: (1) Permeability versus accumulated time, and (2) "Permeability Ratio" (the ratio of the permeability to the initial permeability as measured during the first few minutes of operation) versus accumulated time. On the curves the permeabilities (P) are expressed in feet of flow per day at unit hydraulic gradient for water at 68° F. In accordance with the formulation used by O. E. Meinzer (Reference 2, Page 208):

$$P = \frac{qlt}{Tah}$$

P = permeability, ft/day

q = quantity of water in cubic feet

l = length of column in feet

t = correction for temperature

T = time in days

h = head in feet of water

a = cross-sectional area of column in square feet

The permeability in feet per day may be converted to darcys as used in oil field practice by multiplying by 0.382.

Darcy's equation for permeability may be written as

$$P = \frac{\mu q L}{A \Delta p}$$

P = permeability in darcys

μ = viscosity of water in centipoises

q = quantity of water in cubic centimeter/sec.

L = length of column in centimeters

A = area of cross-section in square centimeters

P = differential total pressure between the inlet and outlet of column

The equation used for reducing the permeameter test data was obtained from the above equation by substitution of appropriate units:

$$P = \frac{Bqt}{\Delta h}$$

P = permeability, ft/day for unit hydraulic head

B = a constant, depending in part on the dimensions of the core samples

q = flow, cc/min.

t = temperature correction factor -See Figure 15.

h = differential head, cm. Hg.

In order to test whether Darcy's Equation for flow in porous media is true for this formation, a flow vs. head test was made on one core (C-4-21). The results in Figure 14 cover a range of differential head from 5 to 25 cm Hg. The relation appears to be linear indicating that Darcy's Equation does hold. This suggests that Reynold's number was less than 1 (Reference 2, p. 67.) It also justified the practice of conserving a limited water supply to the test setup by operating some of the more permeable cores at reduced heads; however, there is reason to question whether a few points taken late in the testing at heads below 2 cm Hg are reliable.

Permeability vs. time curves for the four groups of core samples (MWD water and MWD plus chlorine and acid, MWD plus chlorine, MWD plus acid and MWD deaerated) are presented in Figures 7 and 8, which illustrate the variations between initial permeabilities, the range being from 0.5 to 50 ft/day, the average being about 10 ft/day. After 240 hours of operation the average permeability for each group was 2.5 feet per day[1]

[1] It may be noted that field permeabilities measured by the Los Angeles County Flood Control District near their test well #7, as reported by Laverty et al (Reference 3, pp. 18-19) and (after converting the values from cubic ft. per sec. per square ft. to ft. per day) between 1.0 and 5.0 ft. per day with an average value of about 2.5. Although the Los Angeles County Flood Control District tests were some distance from the Manhattan Beach well field, they were in the same (Silverado) aquifer. This seems to indicate close agreement between field and laboratory work.

for acid treated, 1.7 for chlorine treated, 0.2 for non-treated, and 1.0 for the deaerated. Permeability ratios are likewise presented in Figures 9 and 10. In addition, the values of permeability ratio read from each of the curves on each of the graphs at certain arbitrary times were averaged, resulting in an average permeability ratio curve for each of the groups, which is more easily interpreted; these curves are presented in Figure 11. Each continuous curve represents a group of core samples and the point symbols indicate the water treatment used. Groups I, II, and III were used in the first run, and Groups I and III were continued in the second run. In the third run, Group III was further continued and Group IV started.

In the first run, the average permeability ratios decreased to about 0.4 in two days, regardless of the water treatment. In the untreated group the decrease continued gradually until after a period of 1200 hours the ratio was down to about 0.04.[2] In this same period, the acid treated group and chlorine treated group ratios dropped, but more or less leveled off at about 0.20. The deaerated group (of run 3) permeability ratio dropped to 0.01 in the first two days. The combination of acid and chlorine treatment on the groups previously treated with acid or chlorine alone for 1400 hours indicated a substantial increase in the permeability ratio from 0.2 to 0.4.

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2. Tests on well #7 (Reference 3) using water from the West Basin indicate a decrease to about 30% after 1200 hours operation. This figure is not exactly comparable to the laboratory results since this well had been developed previously and the P_o value was selected as the flow after two days of operation. Nonetheless the trend in permeability ratios is similar to that found in laboratory tests.

After a lapse of six months a second run was started and Group I was continued with no treatment for 2000 more hours. During this time the Permeability Ratio dropped gradually from .08 to 0.01. Hydrochloric acid plus chlorine was then used for about 1200 more hours. HCl sufficient to change the pH from 8.4 to 5.5 and Cl_2 to produce a 5 ppm Cl_2 residual were introduced. After treatment, the permeability ratio of this group increased spectacularly and went as high as 1.4, remaining above 0.4 for at least 1000 hours afterward. Group III, which had been treated with 5 ppm of chlorine for about 1300 hours in the first run, was operated with untreated water for about 2300 hours in the second run. After the first 500 hours, the ratio leveled off near 0.04 where it remained for the duration of the run except for a brief experimental period of 200 hours when filtered-deaerated water was introduced. This treatment showed a slight increase in Permeability Ratio to 0.05.

After another lapse of six months a third run was started with Group III and a new Group IV using filtered deaerated water. Both of these groups dropped fairly rapidly during the first 400 hours and then began to level off, though the downward trend continued until they were shut off with values of Permeability Ratio going as low as 0.01. At the termination of this run, a 50 hour test with acid and chlorine was tried which showed a 4 to 5 fold increase in permeability ratio. This test was not continued long enough to indicate whether the spectacular results shown with Group I could be duplicated.

EFFECT OF CHLORINATION

The treatment of feed water with chlorine, which is a recognized agent in water works practice for the control of biological growth, showed a significant increase in permeability when it was used in Group II of run 1.

Although the MWD water chlorinated at the LaVerne Water Treatment Plant had a chlorine residual of about 1 ppm, by the time this water reached Santa Monica, the chlorine residual had completely disappeared. However, the chlorine demand for the water is low and dosage corresponds closely with the residual obtained upon subsequent chlorination. Figure 12 indicates the pH of the water following various dosages of chlorine in the laboratory. The results show chlorine residual vs pH.

EFFECT OF HYDROCHLORIC ACID

Acid treatment accomplishes a chemical change in the clays in the formation thereby causing them to be less tight and therefore less resistant to the flow. The four cores in Group III were tested with sufficient acid to shift the pH to 5.5 and results of the test showed a significant increase in permeability over the untreated cores in Group I. It was of interest to determine the amount of hydrochloric acid needed to shift the pH of MWD water to a particular value and so pH as a function of quantity of 36.7% HCl was experimentally determined. Results are shown in Figure 13. (Commercial hydrochloric acid normally runs about 32%, so calculations for large scale operations should be based on this figure.)

EFFECT OF ACID PLUS CHLORINE

Acid treatment and chlorine treatment increased the permeability and since they operated on different mechanisms, it was reasoned that the combination of acid and chlorine should increase the permeability even more. To test this hypothesis, a 150-hour experiment was performed on Groups II and III at the end of run 1. The permeability ratios showed a substantial increase. In run 2, the spectacular result shown in Figure 11 was observed when acid and chlorine were applied to

Group I over a period of 200 hours. The average permeability of the cores increased to 1.4 times the initial permeabilities! However, the subsequent decrease in the ratio indicates that the effect was non-permanent but still very good for maintaining a high permeability ratio. Of the various treatments tried, this one seemed to produce the best results. It should be pointed out, however, that this treatment will produce a water which will be corrosive to iron and steel and may cause difficulties if used over extended periods. Perhaps an intermittent treatment program would be worth considering in wells where casings are not protected from corrosive liquids.

EFFECT OF DEAERATION AND FILTRATION

The work done by Christiansen (Reference 8) and Hall (Reference 9) on the effect of air and sediment on percolation seemed to indicate that an improvement in permeability might be found if filtered and deaerated water was run through the cores. Deaerated and filtered water was used for a short time on Group III during run 2 with no appreciable increase in permeability. In run 3, filtered, deaerated water was introduced into Groups III and IV. Contrary to expected results, these cores showed a decrease in permeability comparable to the cores of Group I run with untreated water. The calculated permeability ratios for Group IV appear to be below the values for Group I as seen in Figure 11. From the results of this test, one might conclude that filtered-deaerated water was no better than raw water. One fact should be pointed out, however: during the course of run 3, the turbidity showed a measurable increase to about 3 ppm and at one time a flocculent red precipitate was observed in the deaerated water storage containers. There is some question now regarding the ability of the filter paper used in the base of the filter mat to maintain its strength under continuous saturation and high vacuum. The nature of the turbidity in the storage containers was not investigated to determine whether it came from the filter paper or from the diatomaceous earth and asbestos filter packing. The effect of increased turbidity may have offset the advantageous effects of deaeration. Though no determinations for air bubble size have been made, it may be that air bubbles in the water are sufficiently small to pass through the filters or core samples at atmospheric pressure.

EFFECT OF REVERSAL OF FLOW

Flow reversal from the downward direction could accomplish three things: it might allow entrapped air in the core to escape with the effluent water by virtue of buoyancy; it might permit small particles to be suspended in the moving stream instead of settling out in the normal case; and it might wash out accumulations of fine particles on the top surface of the core sample and improve flow. The observation of no increase in permeability by using deaerated water instead of raw water tends to discount the first proposed theory. The results following reversed flow tests shows a substantial increase in permeability (Figure 9). Since the permeability decreased with time after the reversal of flow, it is assumed that the second theory is improbable. The remaining explanation is not disproved, but rather shows possibly that the flow reversal washes off the plugged surface layer of the inlet side of normal flow and eventually causes plugging of the inlet surface layer of the reversed flow, even though the turbidity of the water was low (less than 1 ppm most of the time). A combination of the second and third effects is possible.

SUMMARY AND CONCLUSIONS

Laboratory tests were performed to study the effects of percolating Metropolitan Water District water into the merged Silverado formation in the Manhattan Beach well field. MWD water was percolated through undisturbed core samples. In addition to using the water as received from the well field, four separate laboratory treatments of the water supply were used: chlorination, acidification, chlorination plus acidification, and filtration plus deaeration. With the exception of the acid plus chlorine treatment, there was an average reduction in the permeabilities to around 40% of the initial value in about 50 hours. Reductions continued thereafter, the average values at 1200 hours being 4% (based on initial permeabilities) for the samples percolated with the regular water, and 15% to 20% for the samples percolated with chlorine and acid-treated waters. The filtered deaerated samples dropped to less than 1% in 1000 hours. Reversing the flow had the effect of temporarily restoring a portion of the lost permeability on two samples with untreated water. A combination of acid and chlorine treatments showed an effect of increasing permeabilities even on samples which had previously been treated with acid or chlorine alone.

The core samples tested using the regular water untreated were subsequently tested with acid plus chlorine treated water which gave spectacular results with one sample showing a gain of 30 times the initial permeability. The data are now sufficient to show that this increase will be long term if the water treatment is continuous. The effect of shock treatment of high concentrations of acid and chlorine have not been investigated but is thought to hold promise.

Some additional tests indicated the following:

1. The MWD water is not incompatible with the water in the aquifer.
2. Bacteria are present in the formation at depths of 150 feet. These bacteria appear to be either aerobic or facultative, and in a dormant state.
3. The native environment in the aquifer is anaerobic.
4. A correlation between chlorine dosage and pH exists for MWD water; there was a considerable scatter among the points, but it can be said that a dosage of 50 to 100 ppm of chlorine would be necessary to bring MWD water to a pH of 5.5.

The tests indicate that over long periods of time, difficulty may be encountered in maintaining the flow with reasonable pressures of MWD water through the Manhattan Beach well field. Chlorine or acid treatments would be beneficial, but chlorine plus acid treatment could be expected to be much more effective in maintaining the permeability of the formation, according to these tests.

RECOMMENDATIONS

Before making recommendations it seems important to look at the objectives of injection of water underground.

It can be seen from the equations for flow of water in a porous medium (Reference 2, p. 375) that the quantity of water entering an aquifer through a well depends on the permeability of the formation and the pressure gradient. For any particular pressure distribution, the quantity of water entering depends on the permeability. It can be shown further that the shape of the pressure mound surrounding the well will not be influenced by the absolute value of the permeability so long as the ratio of permeability to quantity of water remains constant (Reference 4). However, the shape will be influenced by nonuniformities in permeability.

The production of a hydraulic barrier to inland movement of saline waters is accomplished when the hydraulic gradient along the shoreline is seaward. Where recharge wells are used to produce this seaward gradient, the pressure mounds from adjacent wells should overlap so that there is no point at which the gradient remains landward. The spacing of recharge wells is based on the considerations of permeability, flow, head, and mound shape mentioned above.

The laboratory tests show that marked reduction in permeability during the course of recharge operations may be expected. If such decreases are greater near the injection surface (the inner face of the well) than further back in the formation, the result may be the degeneration of the pressure mound system to a sort of "picket fence" - isolated mounds with high pressure gradients, with saline water flowing landward between them. The data seem to indicate that a considerable part of the total reduction in permeability observed during the tests was of this local nature. In theory the continuity of the barrier could be maintained in spite of this effect by sufficiently increasing the pressure in the wells; however, if nothing is done to prevent continued reduction in permeability, the pressures required would sooner or later reach impractical heights.

If, on the other hand, the permeability decrease should be nearly uniform throughout the aquifer, the shapes of the individual mounds, and hence the continuity of the barrier, could be maintained without increasing the well pressure. Such an extensive decrease would cause no [illegible] and indeed could result in material savings in the amount of water required to produce and maintain the barrier. In locations where the objective of a recharge program is to maintain an effective barrier with as little water as possible, the investigation of means to promote an extensive decrease in the permeability of the formation is indicated. There are several possible ways of accomplishing this, one of which is to create a dynamic barrier using a binary fluid system. It is suggested that this be considered for future work on an experimental basis, since it might produce considerable saving in water.

For locations where it appears desirable to increase flows of water into injection wells after they reach a prohibitively low rate, it is recommended that the water be treated with chlorine and acid. Chlorine alone may be sufficient under some circumstances.

In addition to the foregoing, study should be undertaken to determine the effects of recharging aquifers with sewage treatment plant effluents, since this water resource for injection may be less expensive and more readily available than other water. (A specific example would be the study of the injection of Hyperion activated sludge plant effluent in the Silverado formation.) If this were done laboratory studies to determine compatibility of water and effect upon permeability of the formation and the type of treatment required for maintaining flow should prove beneficial.

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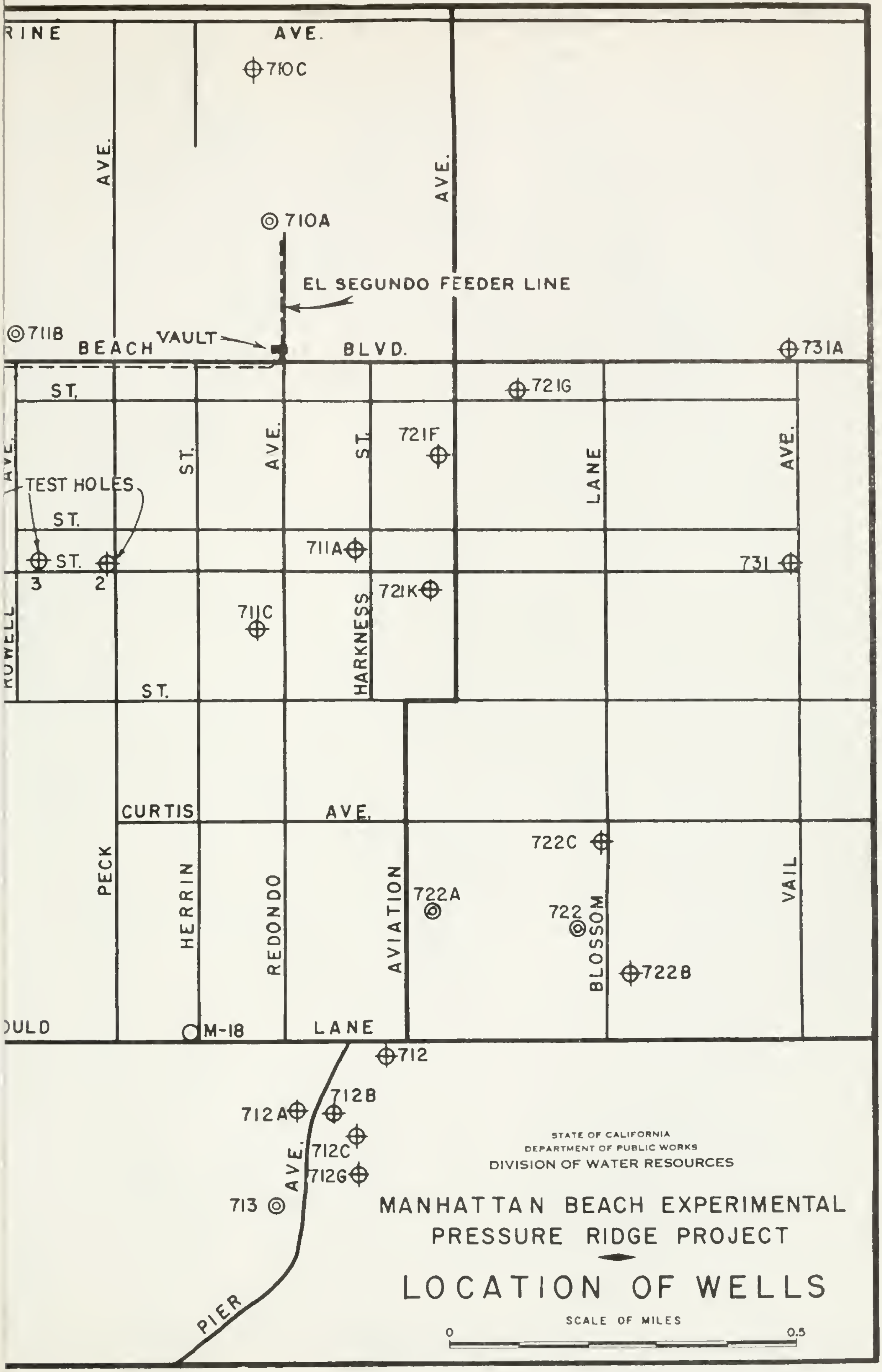

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721F
LANE
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TEST HOLES
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711C
ROWELL
HARKNESS
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CURTIS
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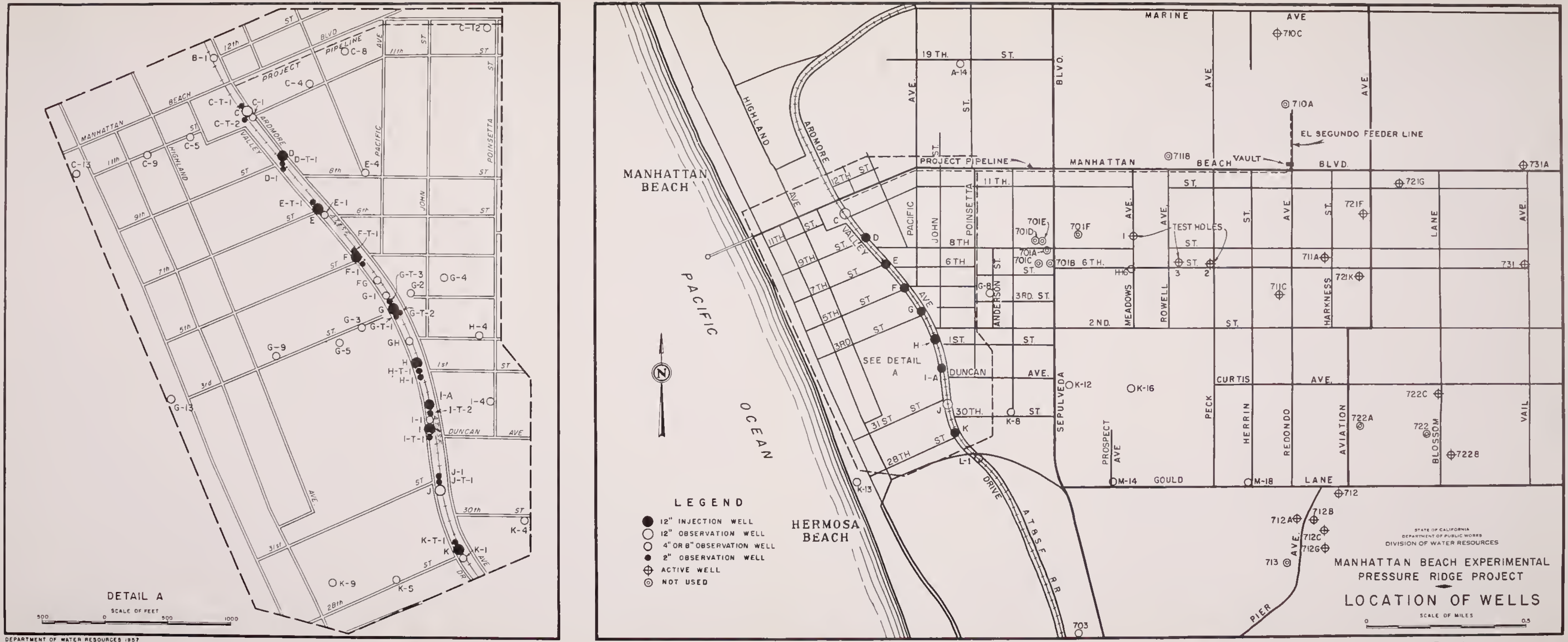
722C
PECK
HERRIN
REDONDO
AVIATION
722A
722
BLOSSOM
VAIL
722B
OULD
M-18
LANE
712
712B
712A
712C
712G
AVE.
713
PIER
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER RESOURCES
MANHATTAN BEACH EXPERIMENTAL
PRESSURE RIDGE PROJECT
LOCATION OF WELLS
SCALE OF MILES
0
0.5

FIGURE 1



DEPARTMENT OF WATER RESOURCES 1957

FIGURE 1

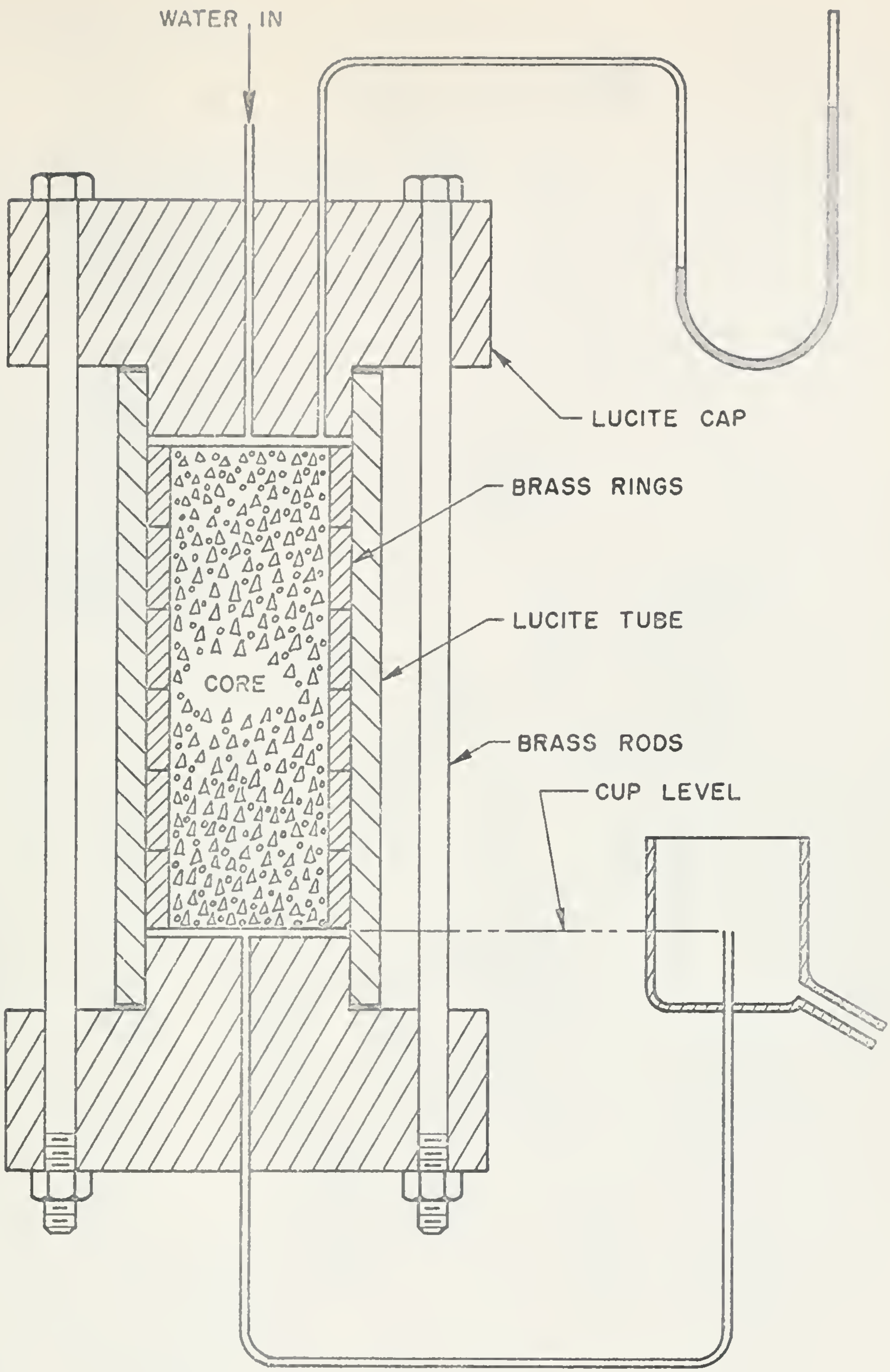


FIGURE 2 PERMEAMETER DETAIL

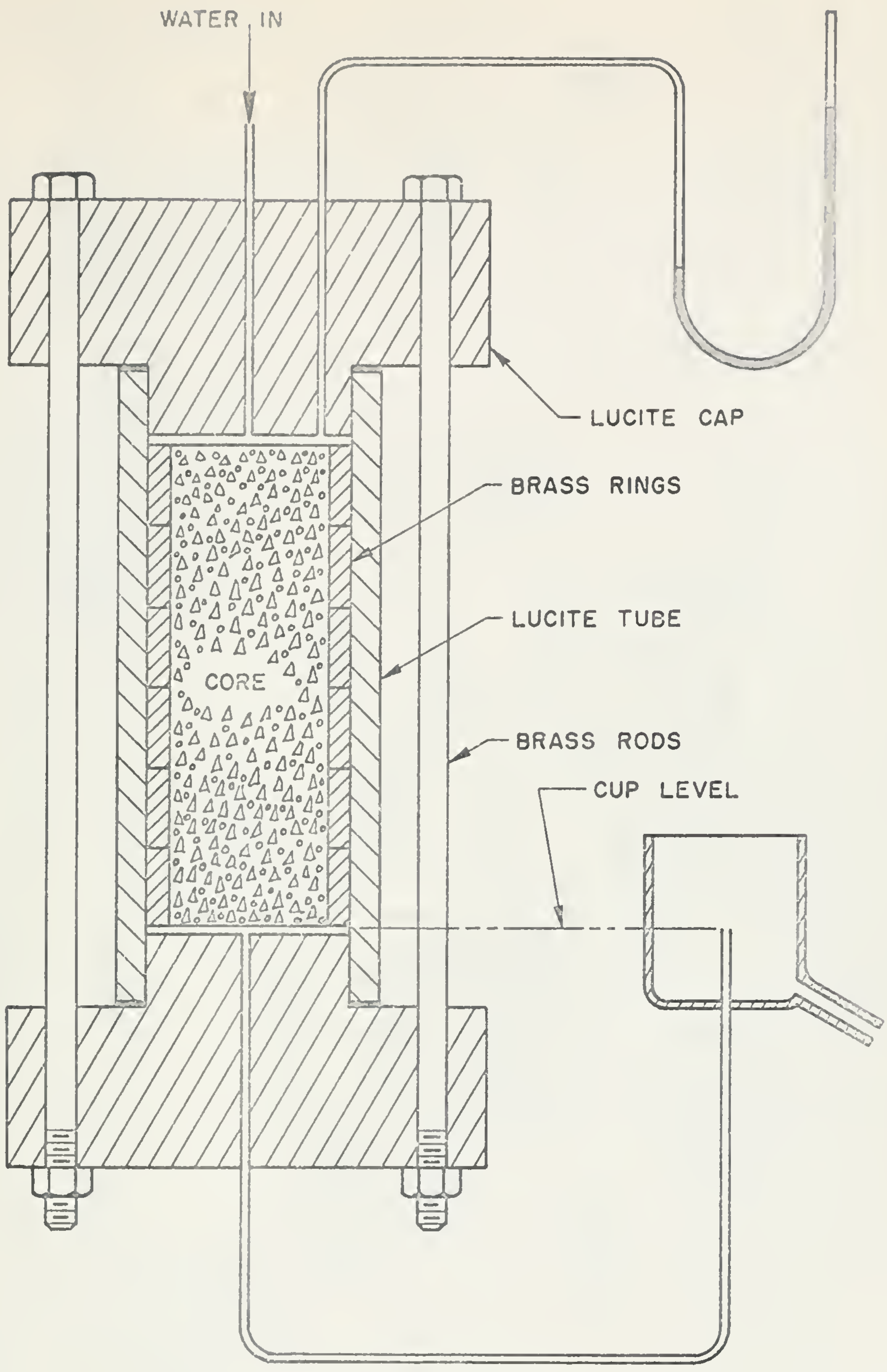


FIGURE 2 PERMEAMETER DETAIL

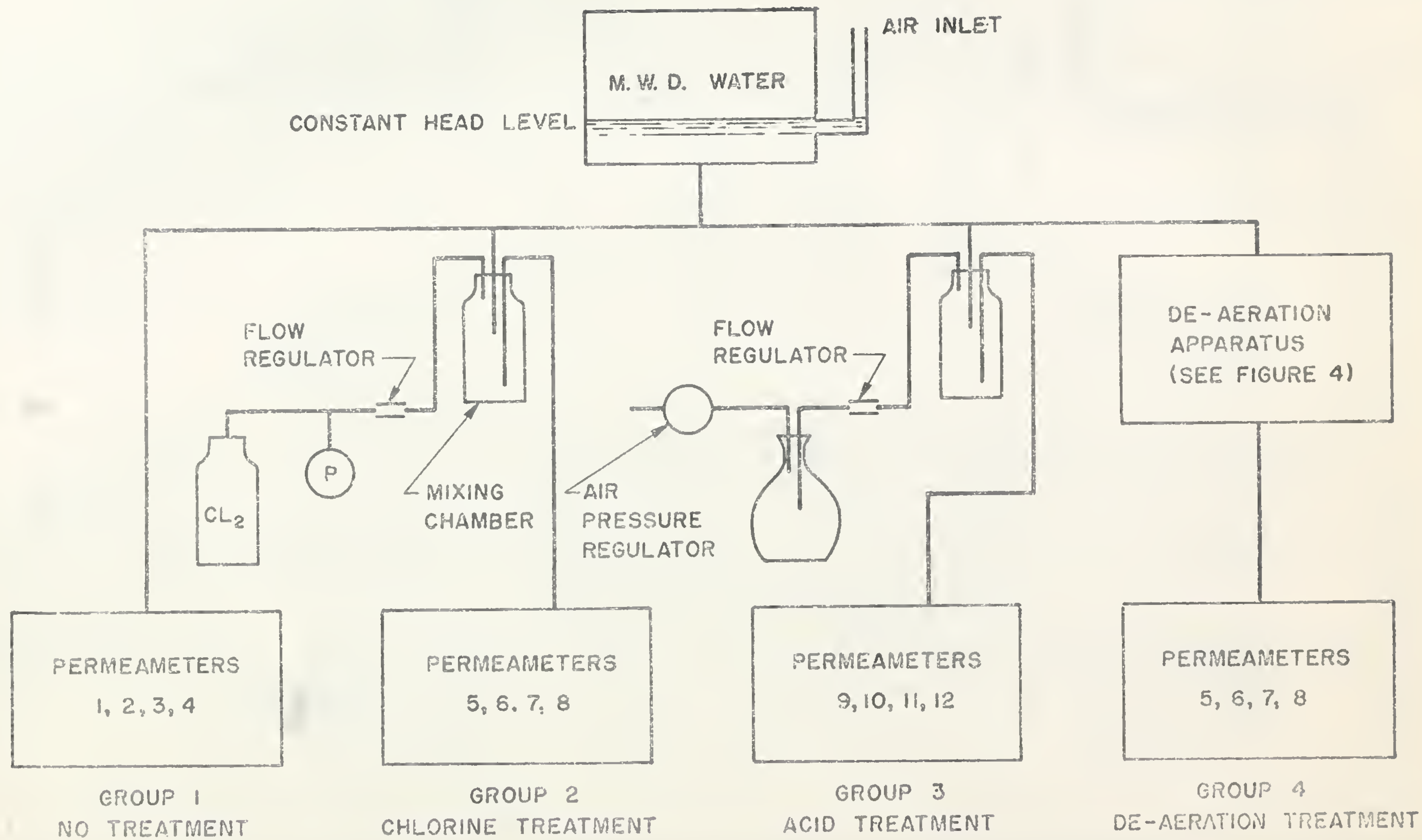


FIGURE 3 PERMEAMETER SETUP

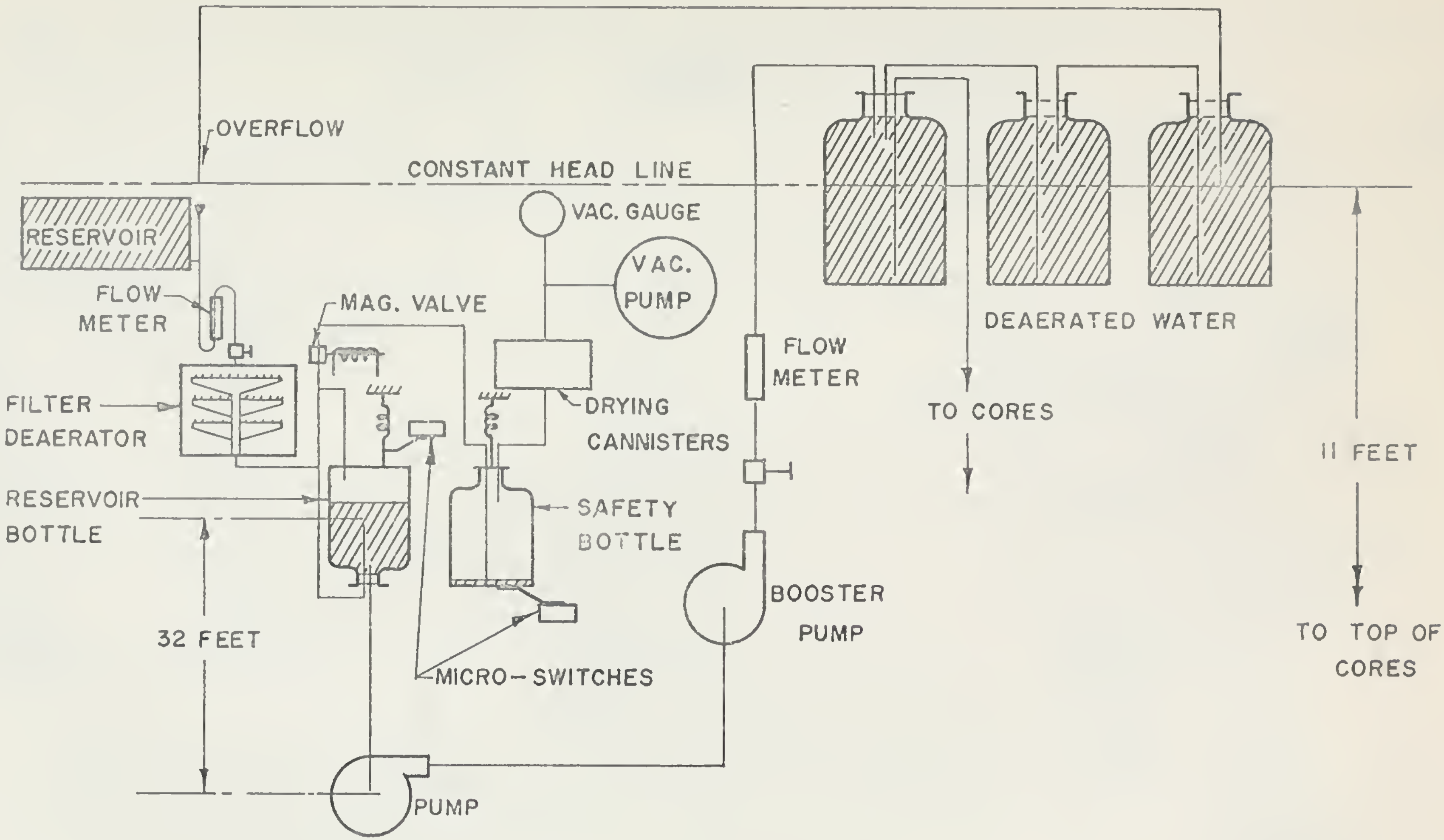


FIGURE 4 DEAERATION SYSTEM

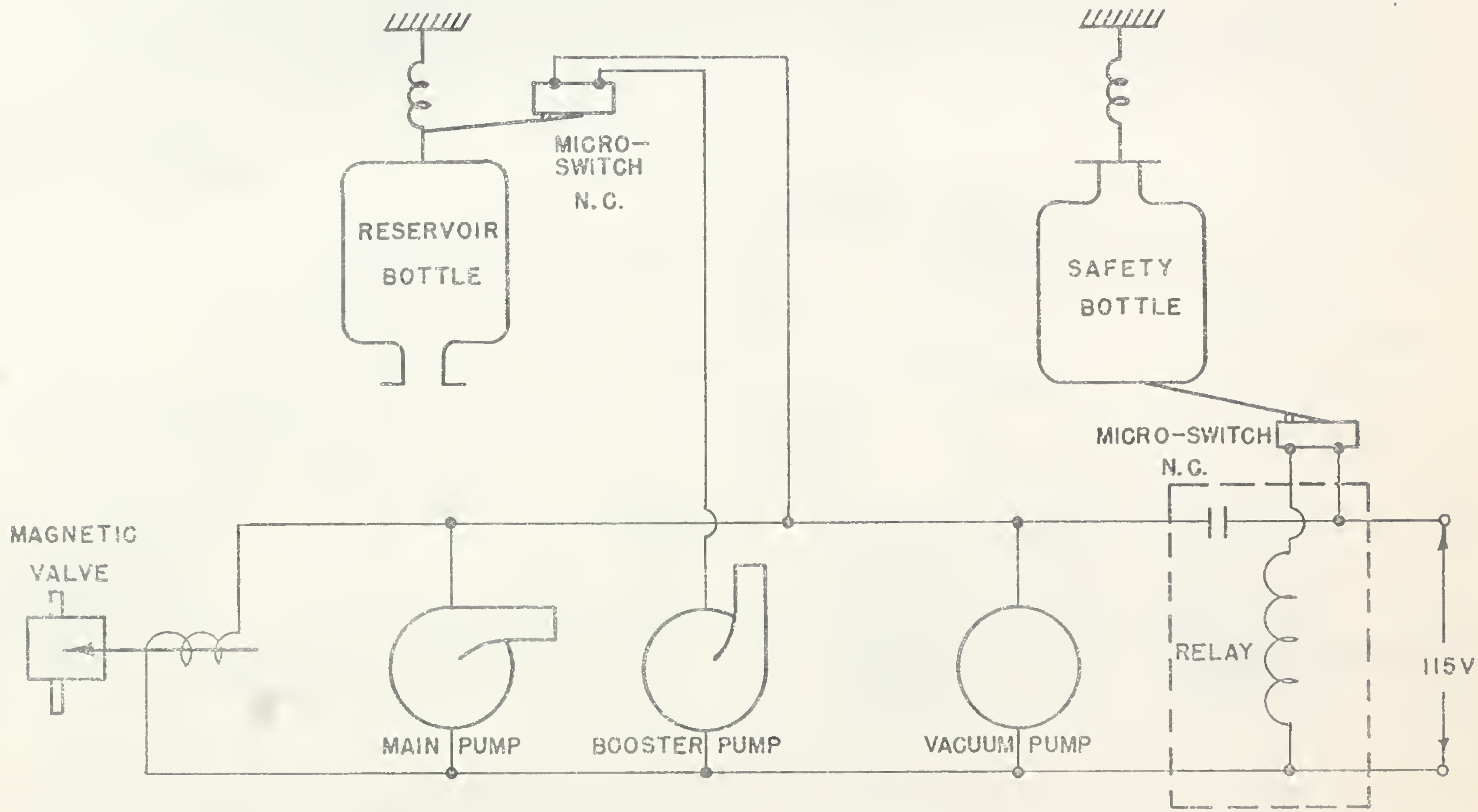


FIGURE 6 WIRING DIAGRAM FOR DEAERATION SYSTEM

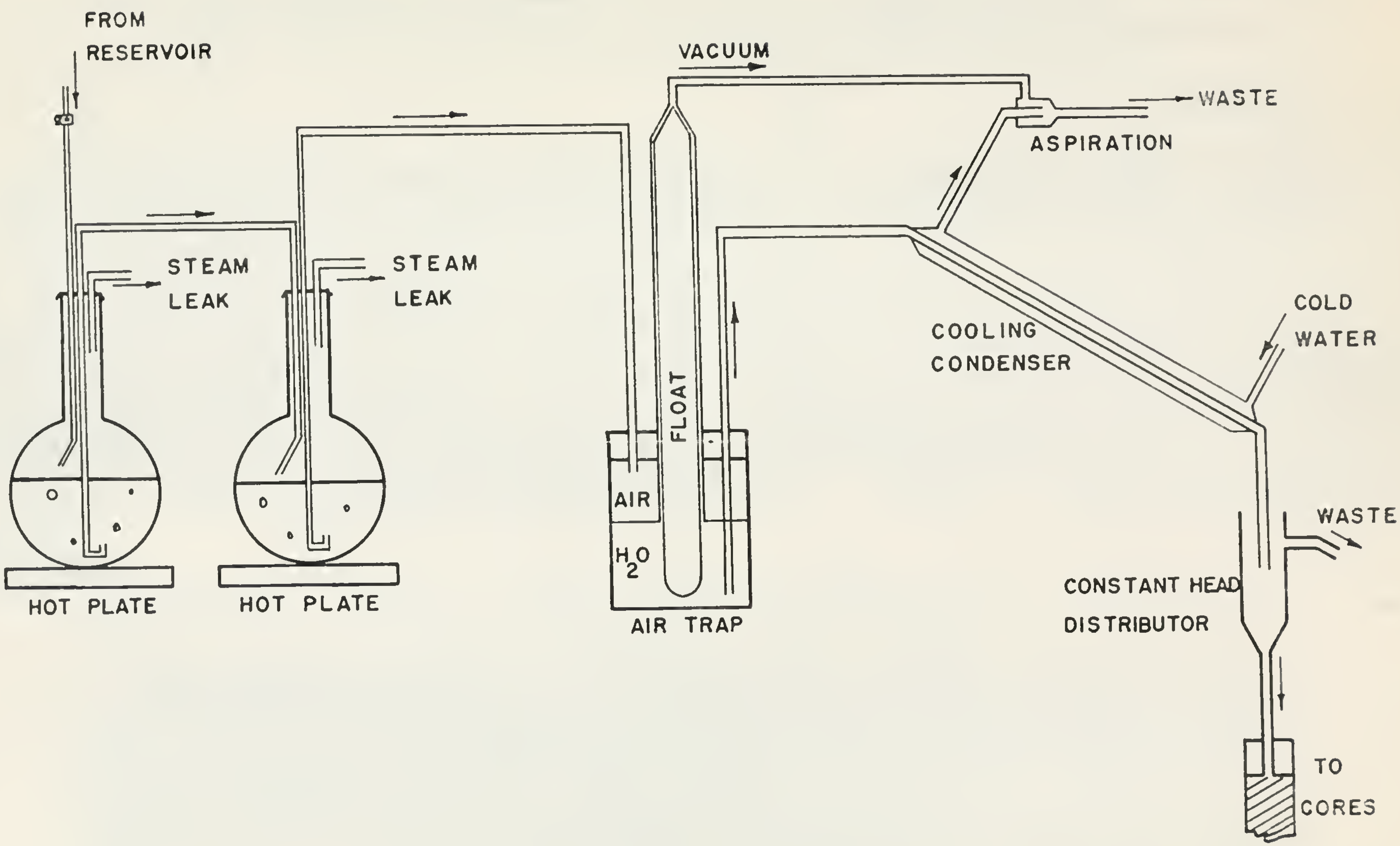
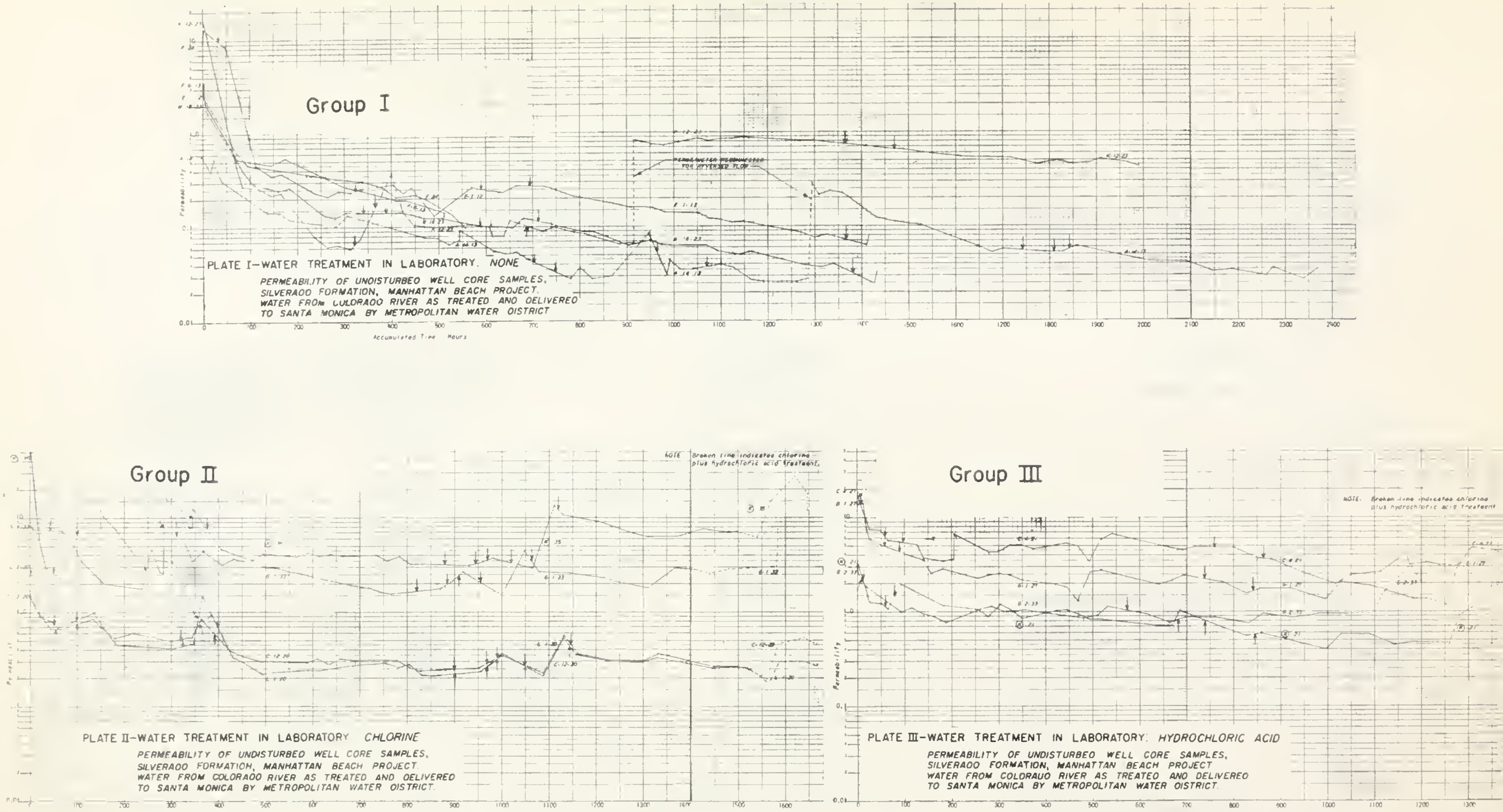


FIGURE C APPARATUS FOR DEAERATION OF WATER BY BOILING

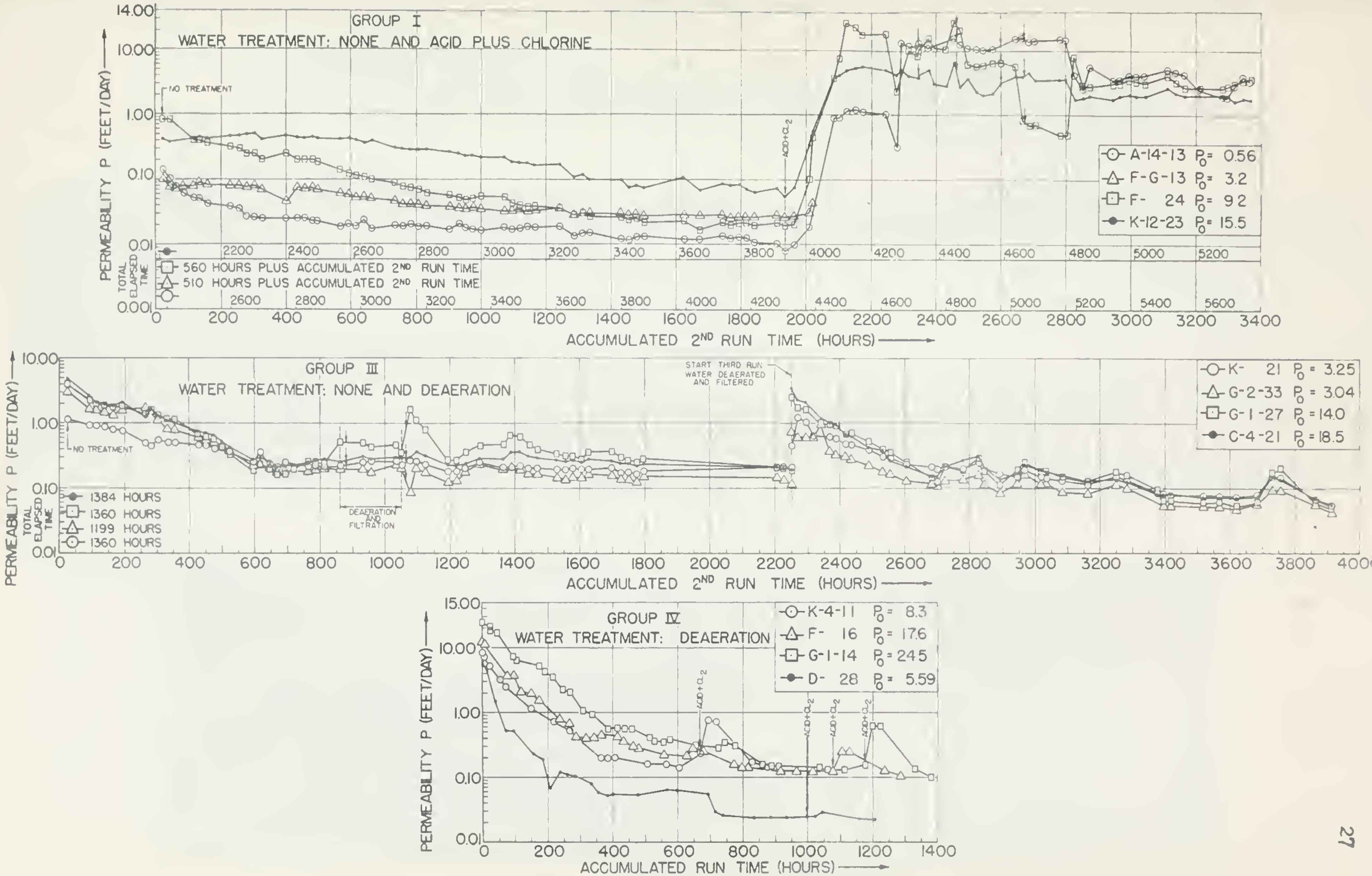


NOTE: Broken line indicates chlorine plus hydrochloric acid treatment.

TIME SCALE: Times shown are accumulated hours of operation, with interruptions deducted. Interruptions are shown by an arrow (↓).
PERMEABILITY SCALE: Units are feet per day of percolation for a hydraulic gradient of one foot head per foot of flow length.
CURVE IDENTIFICATION: Each curve is identified by the well designation (letter and number, or circled letter) and sample number (last number in identification) as furnished by Manhattan Beach Project.

February 1952 to June 1953

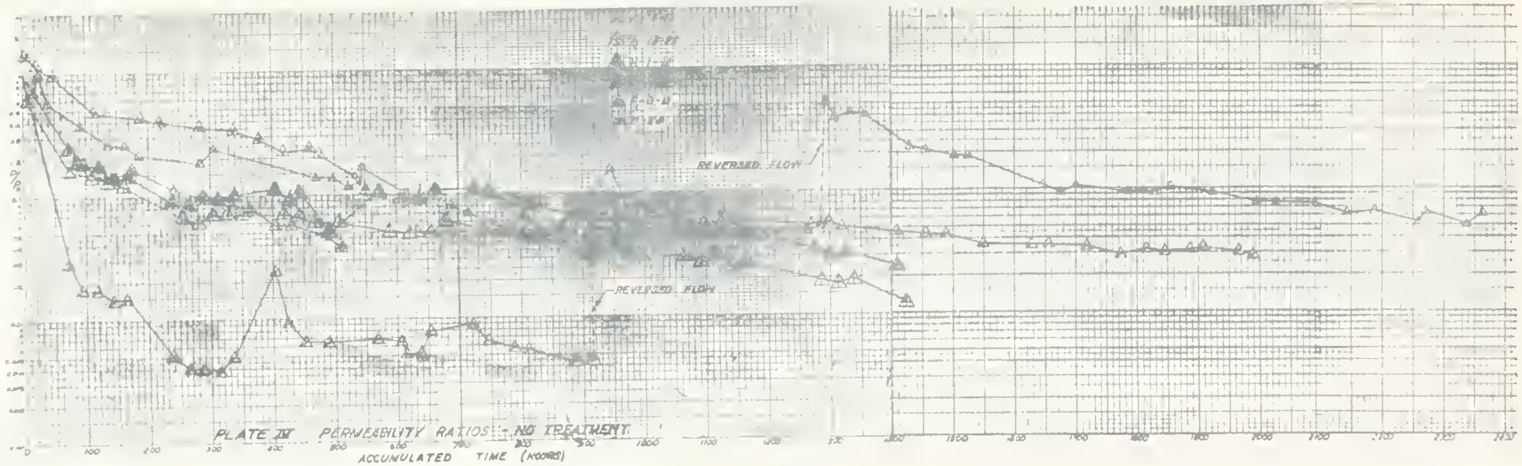
PERMEABILITY VS. TIME
FIGURE 7



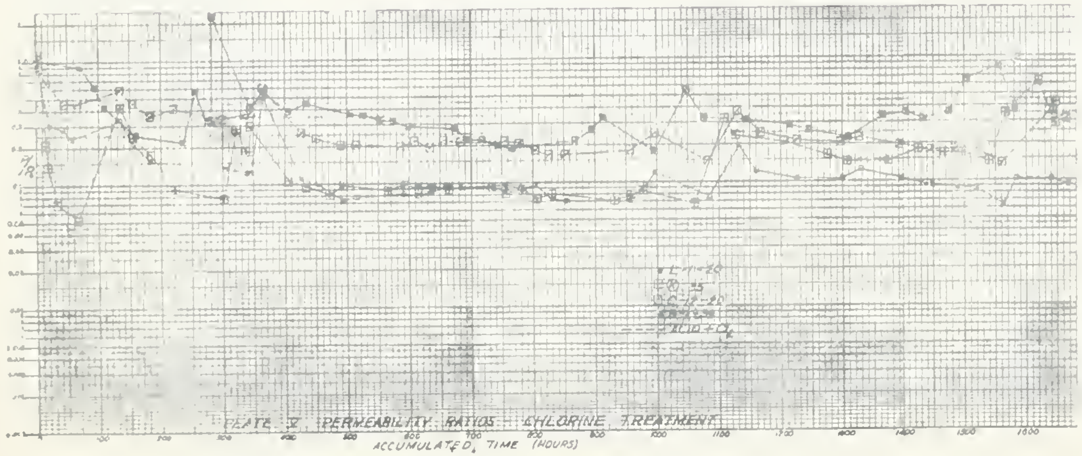
PERMEABILITY VS. TIME
FIGURE 8

July 195? – September 1954

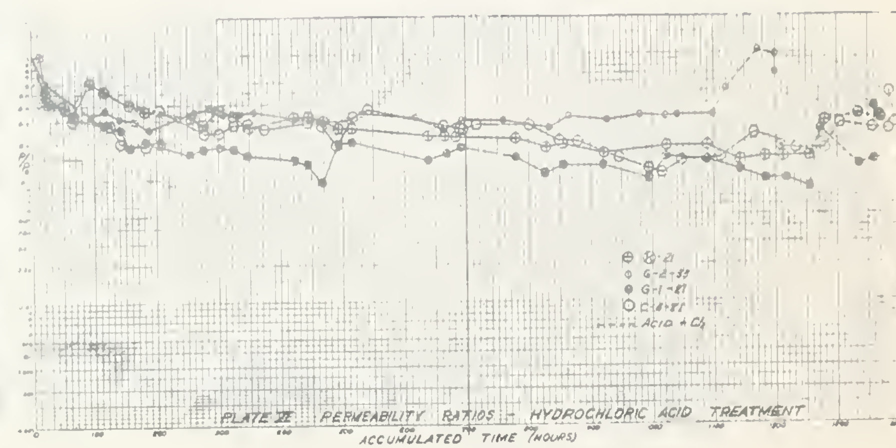
Group I



Group II



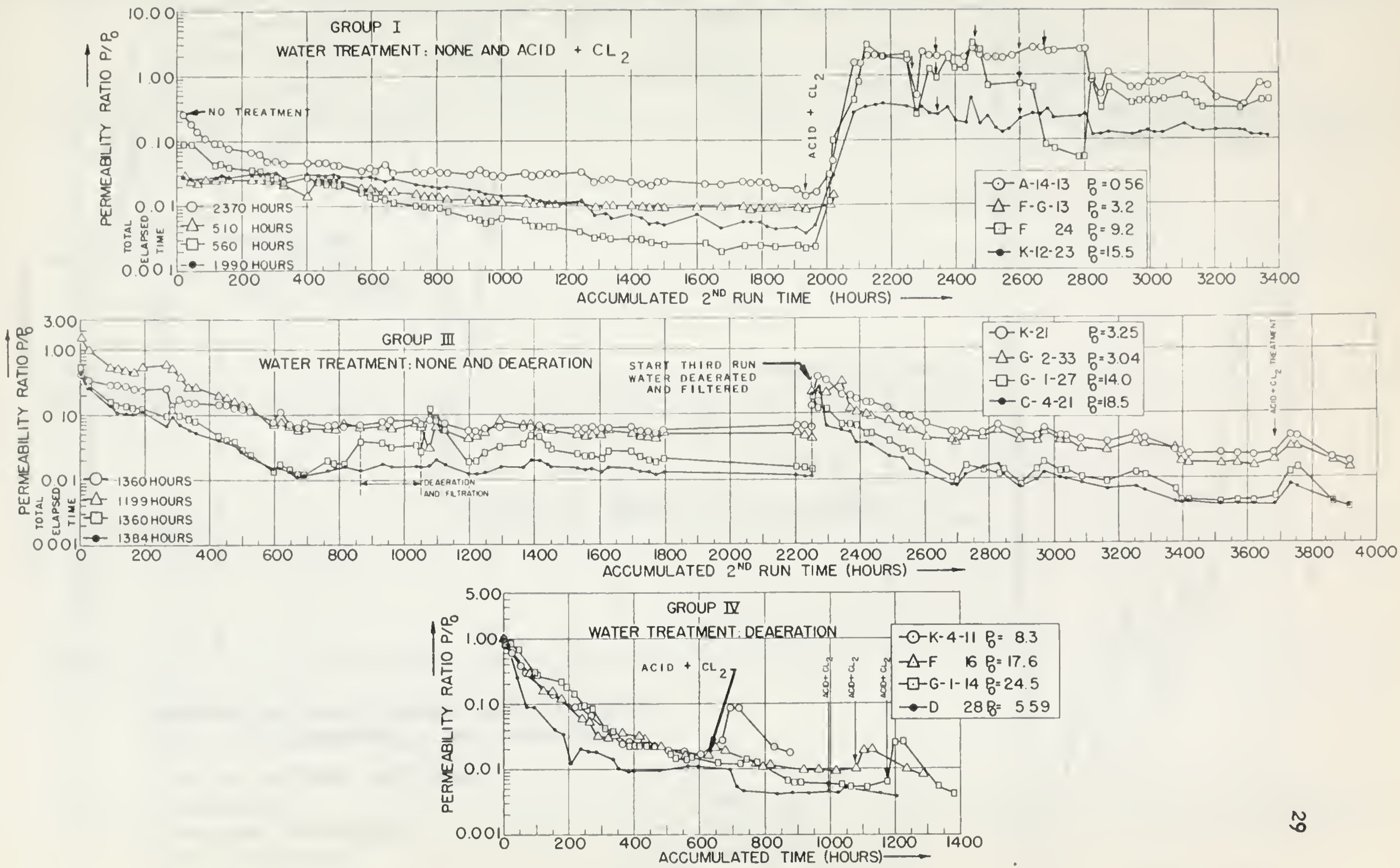
Group III



TIME SCALE: Times shown are accumulated hours of operation, with interruptions deducted.
PERMEABILITY RATIO SCALE: Permeability Ratio is the ratio of the permeability P at any time to the initial permeability P_0 as measured during the first few minutes of operation of a core sample.
CURVE IDENTIFICATION: Each curve is identified by the well designation (letter and number, or circled letter) and sample number (last number in identification) as furnished by Manhattan Beach Project. Feb., 1952 to June 1953

PERMEABILITY RATIO VS. TIME

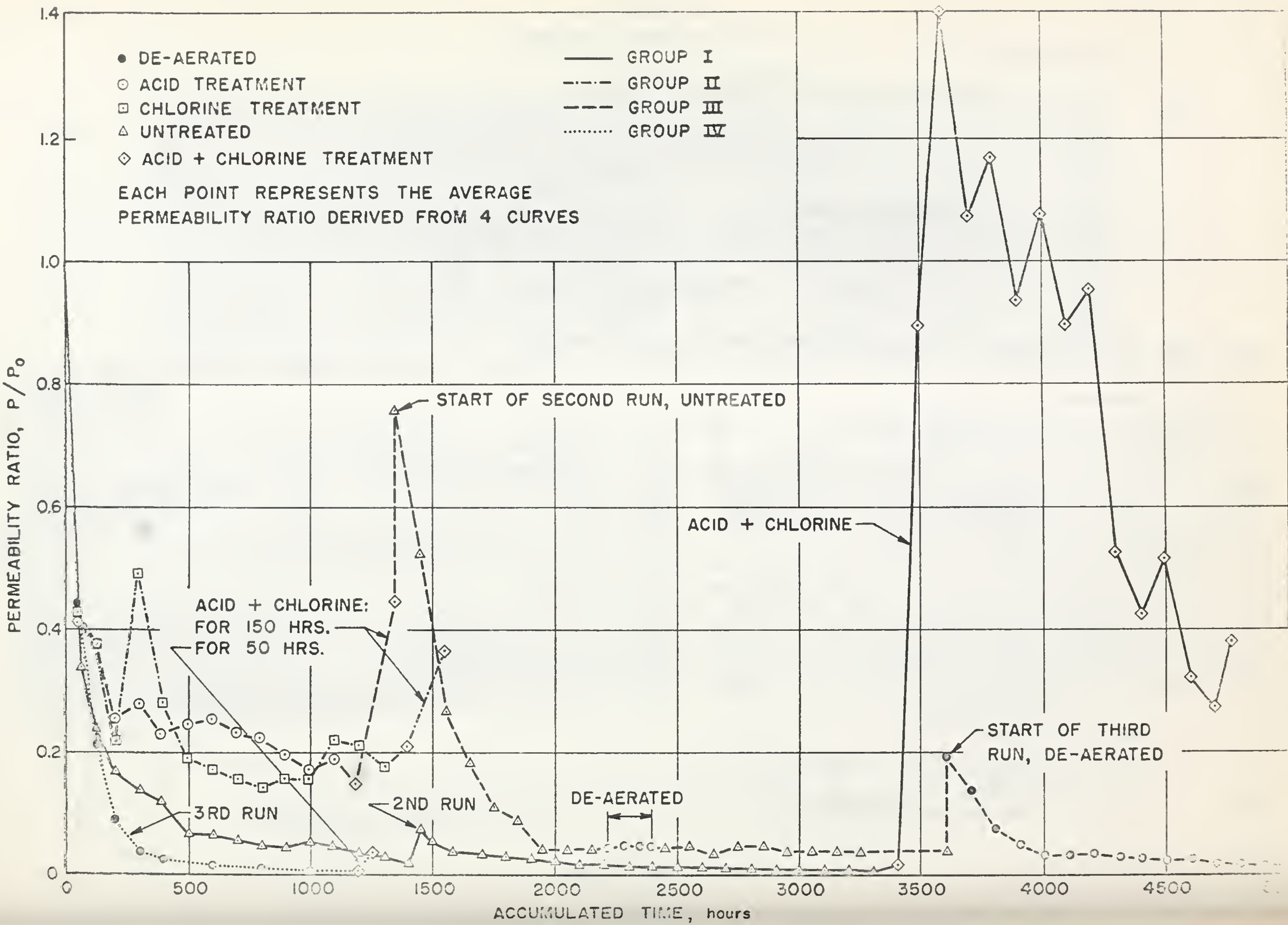
FIGURE 9



July 1953 to Sept. 1954

PERMEABILITY RATIO VS. TIME

FIGURE 10



• DE-AERATED
⊙ ACID TREATMENT
⊡ CHLORINE TREATMENT
△ UNTREATED
◇ ACID + CHLORINE TREATMENT
EACH POINT REPRESENTS THE AVERAGE
PERMEABILITY RATIO DERIVED FROM 4 CURVES
GROUP I
GROUP II
GROUP III
GROUP IV
START OF SECOND RUN, UNTREATED
ACID + CHLORINE
ACID + CHLORINE:
FOR 150 HRS.
FOR 50 HRS.
3RD RUN
2ND RUN
DE-AERATED
START OF THIRD
RUN, DE-AERATED
PERMEABILITY RATIO, P/P_0
ACCUMULATED TIME, hours
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
500
1000
1500
2000
2500
3000
3500
4000
4500

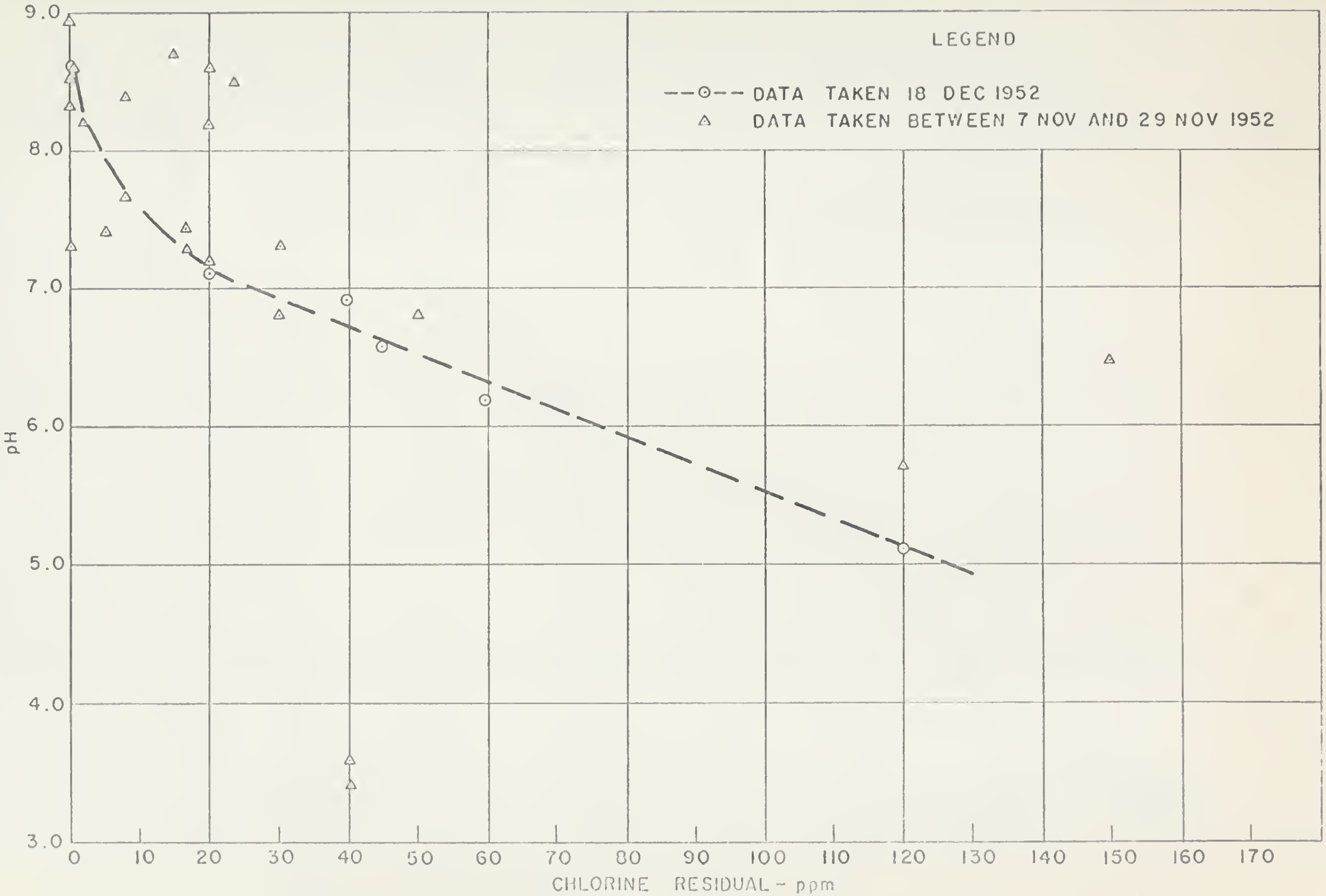


FIGURE 12 pH VS CHLORINE RESIDUAL FOR METROPOLITAN WATER DISTRICT WATER AS DELIVERED TO SANTA MONICA

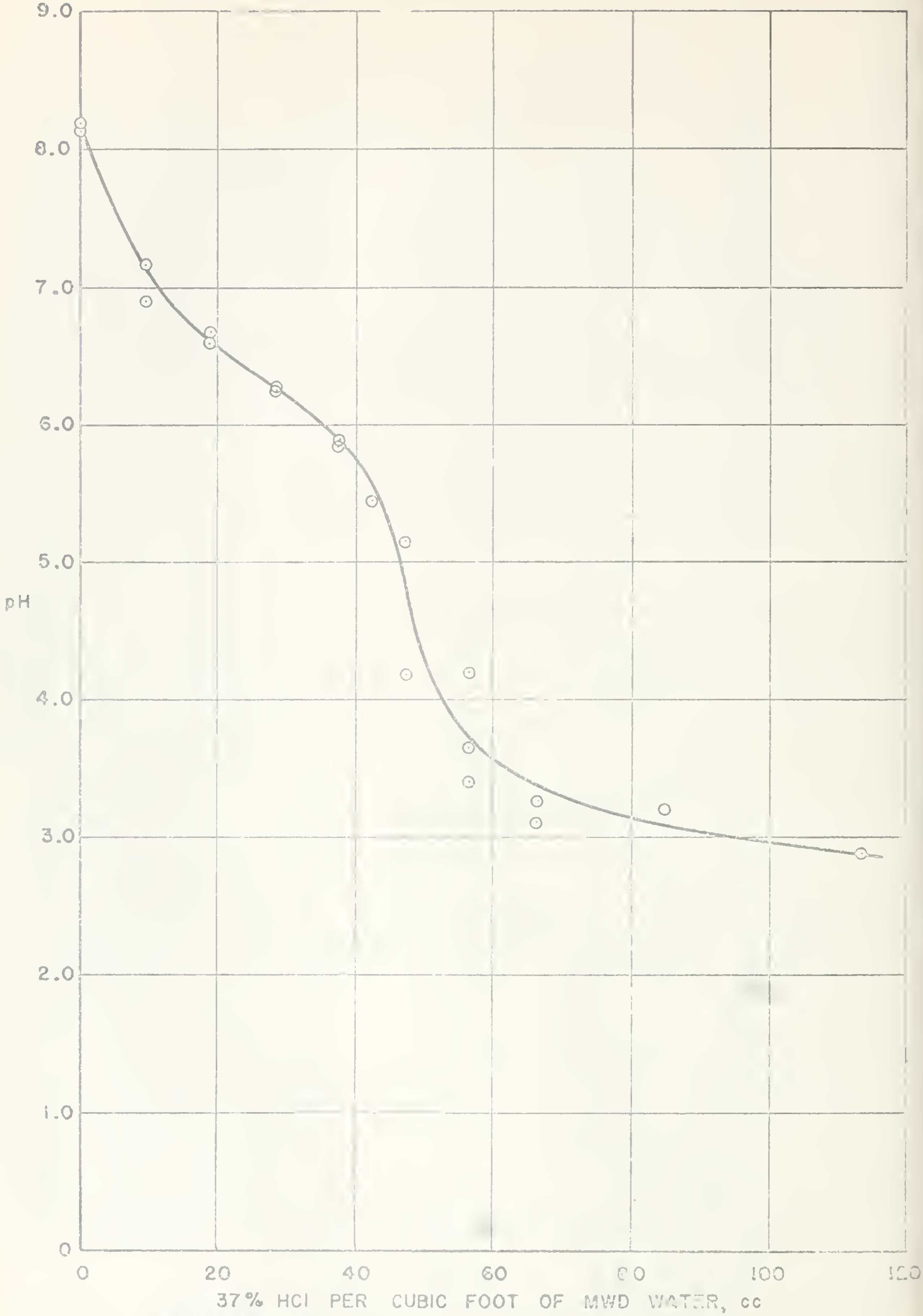


FIGURE 13 pH VS HYDROCHLORIC ACID DOSAGE

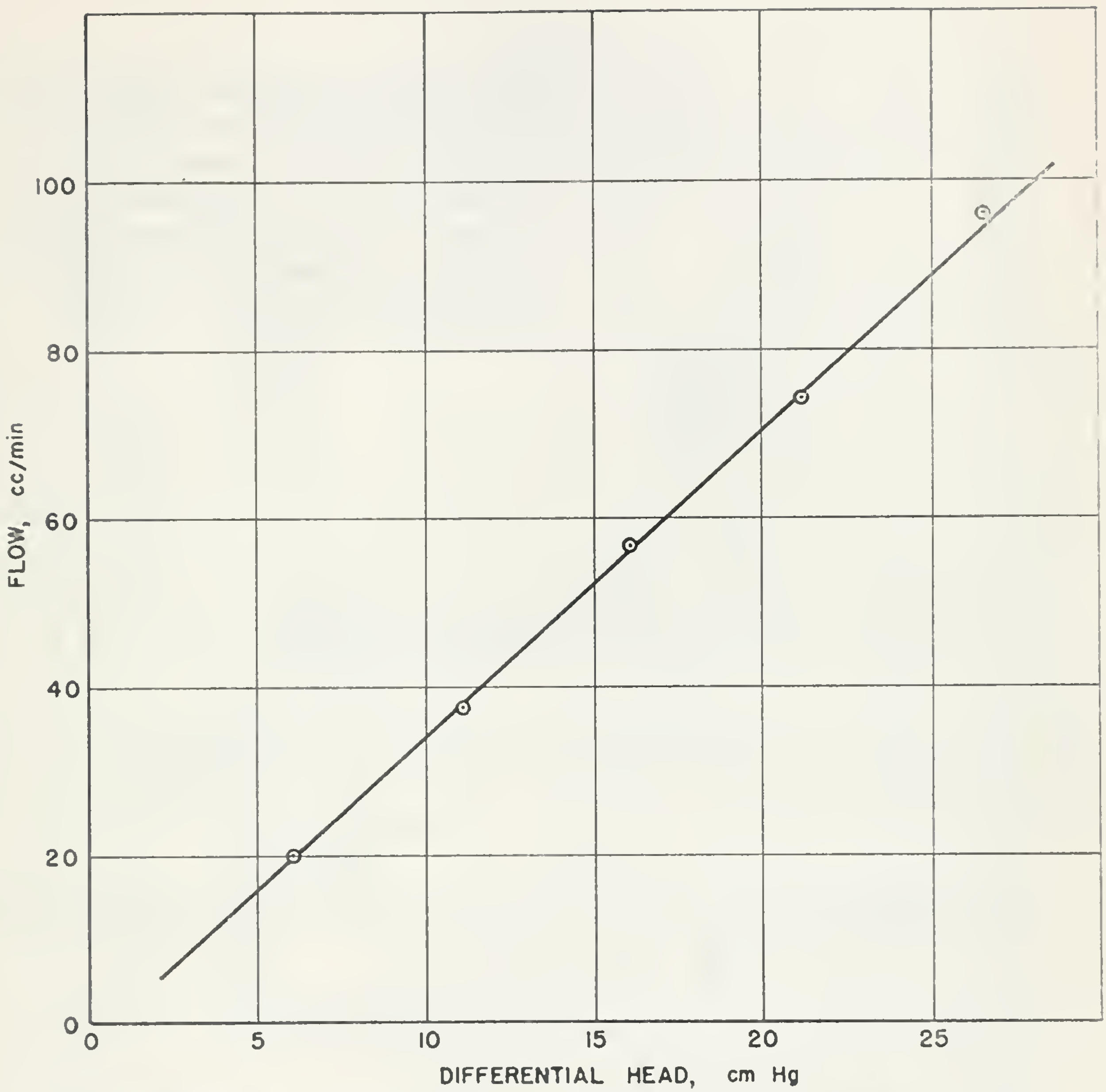


FIGURE 14 FLOW VS DIFFERENTIAL HEAD FOR WELL CORE SAMPLE C-4-21

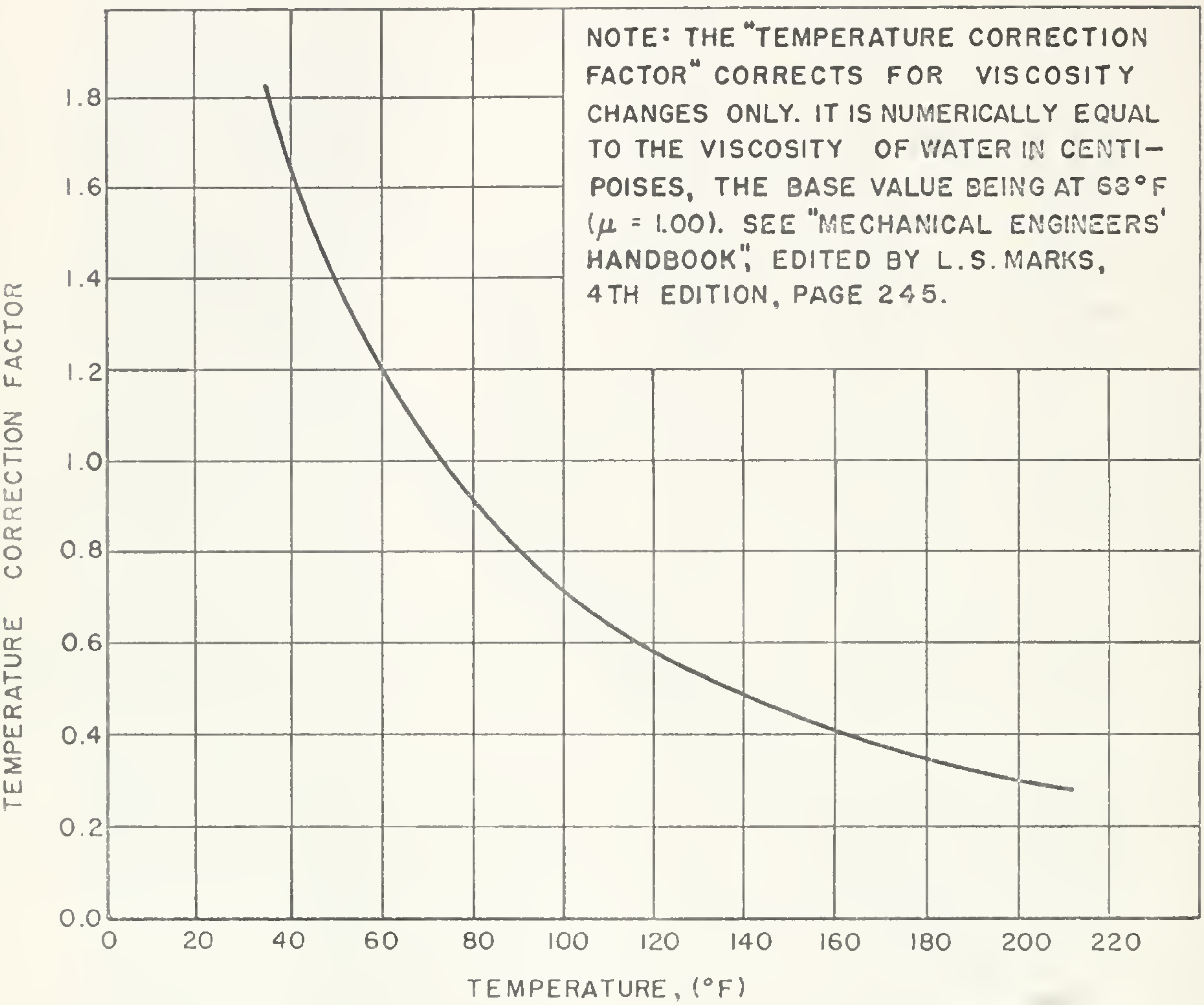


FIGURE 15 TEMPERATURE CORRECTION FACTOR FOR REDUCTION OF DATA

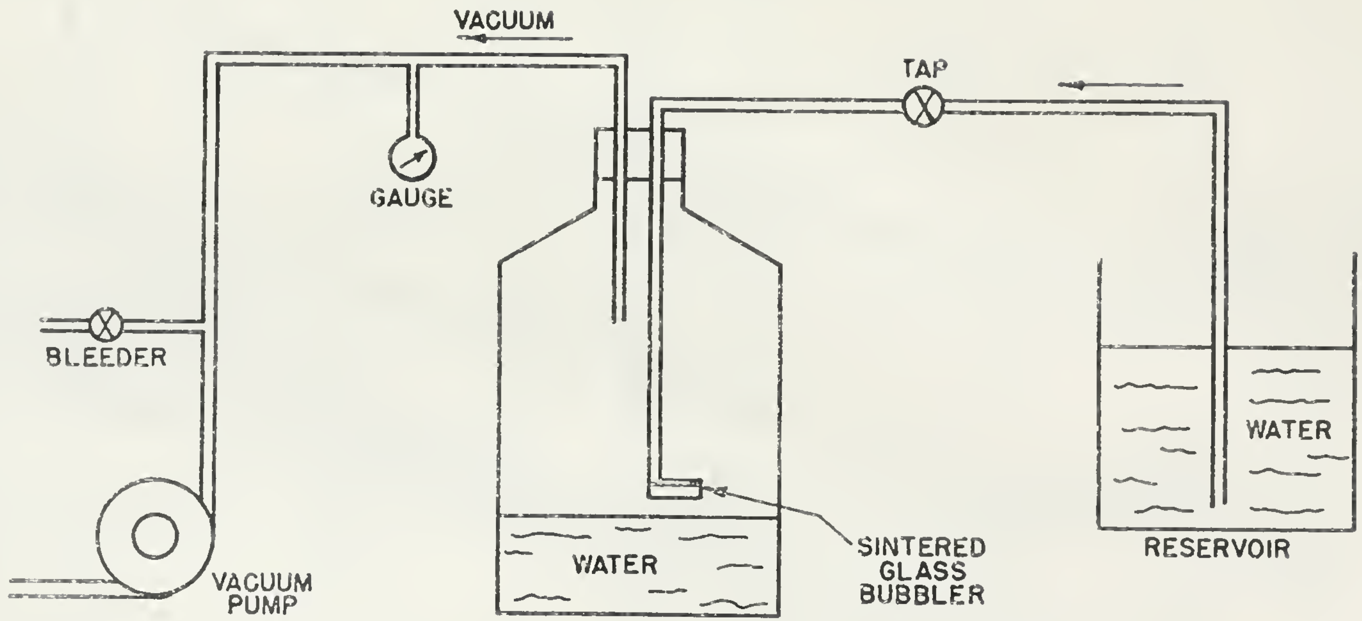


FIGURE 10 TEST APPARATUS FOR VACUUM DE-AERATION OF WATER

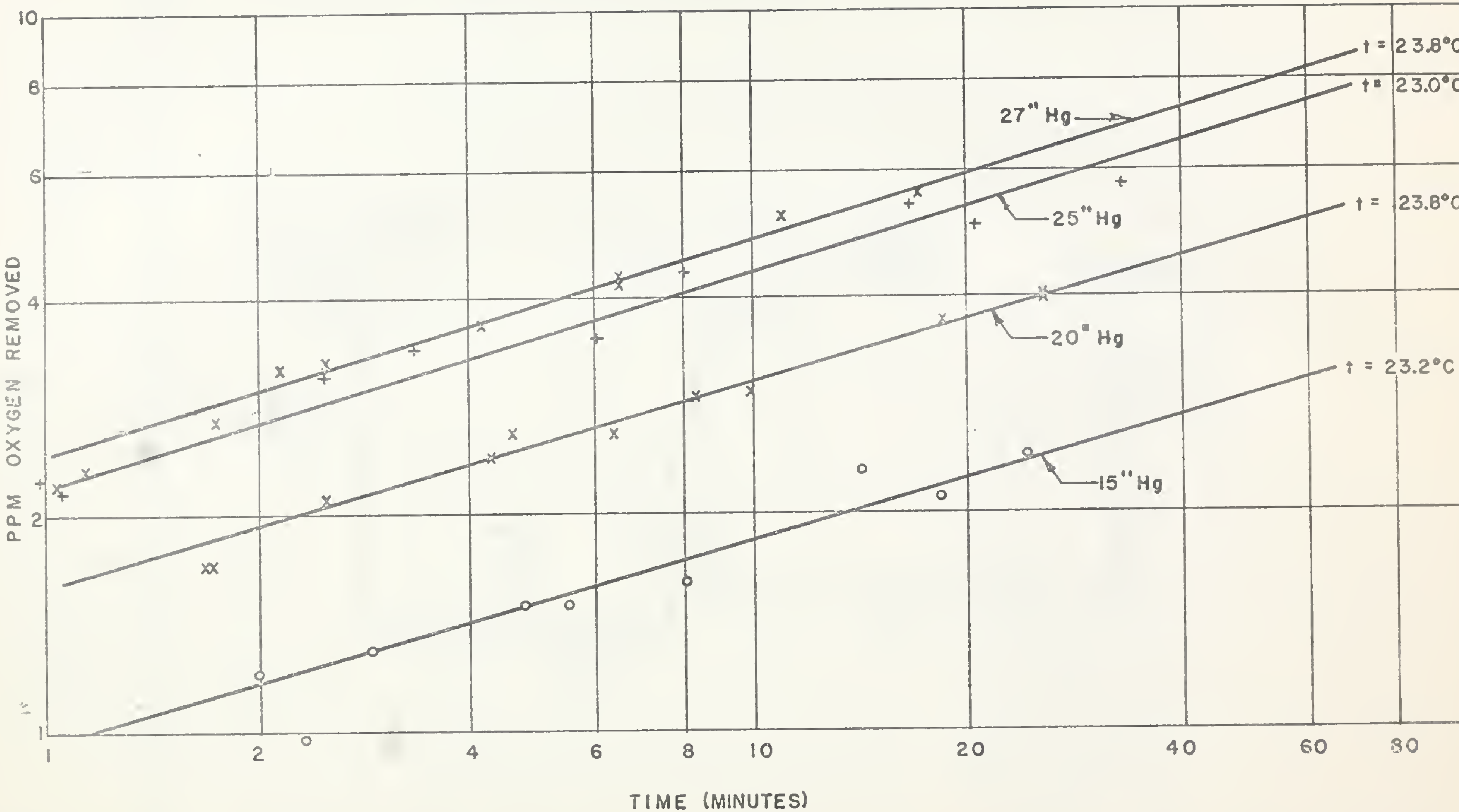


FIGURE 17 OXYGEN REMOVED FROM 500ML OF WATER VS TIME, VARYING VACUUMS

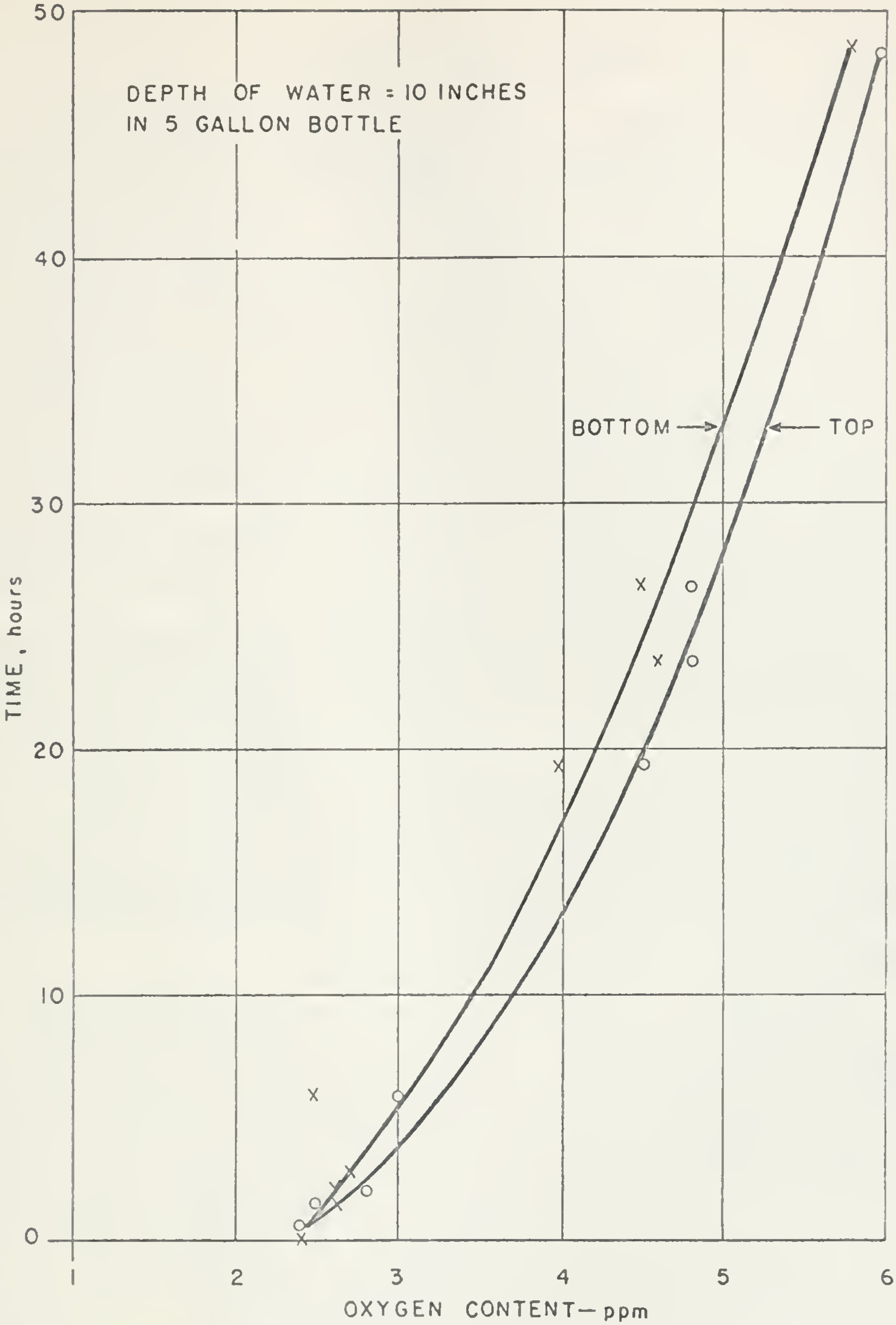


FIGURE 18 RE-AERATION OF DE-AERATED QUIESCENT WATER

DE-AERATION SYSTEM DESCRIPTION

De-aeration of water can be accomplished in several ways: (1) by boiling, (2) by diffusion, (3) by ultrasonic vibration (reference 4), or by combinations of (1), (2) and (3). The process employed in this project was diffusion of air through water passing through the capillaries of a filter under reduced pressure. Capillaries were produced by packing the filter (Sparkler Mfg. Co. Model 8-3, stainless steel, 4-plate unit) with type K-3 filter paper (having rag base) approximately 8 in. in diameter using asbestos and diatomaceous earth Celite Super-cell precoat. The cross-sectional area of the filter through which the water flowed (average flow = 200 cc/min) was about 150 in^2 and thickness of the packing and paper was about 0.2 in. Turbidity of water passing through the filter was less than 1 ppm on the SiO_2 scale measured on the Hellige Turbidimeter using the 50 mm deep cell and dark filter. The effluent side of the filter was maintained at vacuums from 27 to 29 in. Hg. The pressure drop across the filter was about 1 in. Hg. The remaining pressure difference was across the inlet valve to the filter.

The equipment employed for de-aeration and filtration is shown diagrammatically in Figure 4. MWD water was stored in the reservoir on the roof and flowed under a head of approximately 8 feet through the flowrator into the de-aerator filter located in the laboratory. The water then flowed along the sides of the effluent line from the filter into the inverted reservoir bottle which was maintained at the system vacuum. The reservoir bottle was suspended from a spring which was elongated proportionately to the weight of water in the bottle. A micro-switch was activated by the spring elongation and turned the booster pump on and off.

From the reservoir bottle the water flowed to the main centrifugal pump located on the main floor 32 feet below the bottle. The 32 feet head at the pump restored the water pressure to atmospheric and insured the system against air leakage through the pump packing. Since the discharge pressure of the pump was not sufficient to lift the water to the roof, a centrifugal booster pump was installed at the laboratory level and utilized to regulate the flow automatically by means of the micro-switch on the reservoir bottle. A check valve above the booster pump prevented reverse flow from the storage bottles into the system when the pump was not in operation. The flow to the three bottles on the roof was therefore intermittent but with no consequence since exposure to air was prevented by the first two bottles. The water to the cores was supplied from the first bottle. Except for the time of occasional system shut-offs, the de-aerated water supply rate was in excess of the water consumption rate of the cores and the excess was returned to the reservoir tank.

Because of difficulties experienced in keeping the system in balanced operation, a safety bottle and a magnetic valve were incorporated to prevent water from backing up into the vacuum pump. If, for any reason, the water filled the reservoir bottle and filter, the water flowed into the safety bottle until its weight elongated the spring enough to open the micro-switch which opened a relay circuit (Figure 5). The relay then shut off power to the main pump, booster pump, vacuum pump and the magnetic valve, which isolated the vacuum pump from the rest of the system.

It was necessary to install silica gel drying canisters before the vacuum pump to remove water vapor from the air which otherwise would condense in the pump. The silica gel had to be re-activated periodically.

Table 1. Chemical and Physical Properties of the Water.

PLACE OF SAMPLING	Well E-4	Well I-1	M.W.D. Water
DATE OF SAMPLING	7-7-52	7-7-52	9-19-52 (Tank#
TURBIDITY, ppm SiO_2	50	25	0.5
COLOR	20**	25**	0
ODOR	NA	NA	NA
pH	7.3	7.1	
ALKALINITY, total	117	109	56
HYDROXIDE, ppm $CaCO_3$	0	0	
CARBONATES, ppm $CaCO_3$	0	0	
BICARBONATES, ppm $CaCO_3$	104	91	45
ACIDITY, ppm $CaCO_3$	13	18	11
DISSOLVED OXYGEN, ppm O_2	0	0	—
DISSOLVED CO_2, ppm CO_2	0	—	—
SOLIDS, total ppm	51,880	36,133	608
SUSPENDED, ppm	148	36	6
DISSOLVED, ppm	51,532	36,097	602
CHLORIDES, ppm Cl	17,800	17,000	138
SULFATES, ppm SO_4	2,508	2,360	251
CALCIUM, ppm $CaCO_3$	1,160	2,000	78
MAGNESIUM, ppm $CaCO_3$	4,740	4,100	52
AMMONIA, ppm N	0	0	0
NITRATES, ppm N	1.9	1.3	1.3
NITRITES, ppm N	0	0	0
ORGANIC NITROGEN, ppm N	0	0	0
TOTAL NITROGEN, ppm N	1.9	1.3	1.3
POTASSIUM, ppm K	140	85	5.8
SODIUM, ppm Na	9,250	9,250	174
PERCENTAGE SODIUM			
CONDUCTIVITY, K x 10^5	5,250	5,250	117
BORON, ppm B	3.0	2.5	0.2
PHOSPHATES, ppm PO_4	0	0	0.4

**Sample poured undisturbed.

Table 2. Summary of Well Core Samples Tested

Well No.	Core No.	Depth ft.	I.D. in.	Length in.	1952 Collected Date	Started Date	Ended Date	Accumulated Hours	Group	Data in Table No.
A-14	Disturbed	206	2	10	10 July	26 Aug '52	10 Nov '52	1797	—	—
A-14	13	183.5	2-3/8	6	9 July	27 Aug '52	7 Jan '52	6701	I	3
C-4	21	208.5	2-13/32	6	25 May	7 Oct '52	24 Aug '54	5173	III	4
C-8	—	261.0	2-13/32	5½	8 May	25 Aug '52	27 Aug '52	—	—	—
C-12	20	200.5	2-7/16	6	9 June	24 Sept'52	5 Dec '52	1664	II	5
D	28	198.1	2-3/8	6	3 Oct	5 July'54	24 Aug '54	1204	IV	6
E-1	12	158.5	2-13/32	6	18 June	12 Sept'52	11 Nov '52	1415	I	7
F	16	149.0	2-7/16	6	19 Sept	2 July'54	24 Aug '54	1284	IV	8
F	24	159.2	2-3/8	6	22 Sept	12 Nov '52	5 Jan '54	4845	I	9
FG	13	141.5	2-3/8	6	22 Oct	14 Nov '52	2 Oct '53	2532	I	10
G-1	14	134.0	2-7/16	6	—	28 June 54	24 Aug '54	1380	IV	11
G-1	27	179.5	2-13/32	6	4 Mar	7 Oct '52	24 Aug '54	1662	III	12
G-1	33	194.0	2-7/16	6	4 Mar	25 Sept'52	5 Dec '52	1582	II	13
G-2	33	190.5	2-3/8	6	18 Mar	16 Oct '52	24 Aug '54	5112	III	14
G-4	25	218.9	2-3/8	6	17 Mar	17 Jul '54	24 Aug '54	875	IV	15
G-5	40	253.2	2-3/8	6	12 Sept	7 Oct '52	16 Oct '52	—	—	—
I-1	—	141.5	2-13/32	5-3/4	26 June	21 Aug '52	25 Aug '52	—	—	—
K	21	195.5	2-3/8	6	5 Sept	7 Oct '52	24 Aug '54	5273	III	16
K	35	295.5	2-3/8	6	10 Sept	23 Sept'52	5 Dec '52	1644	II	17
K-4	11	185.2	2-3/8	6	22 May	27 June 54	17 Jul '54	480	—	—
K-12	23	318.5	2-13/32	6	9 June	12 Sept 52	7 Jan '54	6328	I	18
L-1	20	124.2	2-3/8	6	19 Sept	23 Sept 52	5 Dec '52	1666	II	19
M-18	23	290.5	2-3/8	6	24 July	11 Sept 52	11 Nov '52	1430	I	20

Table 3. Group I, Permeameter Data
Well A-14, Sample No. 13
Depth 183 Feet.

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
27 Aug '52	1745	0	13.0	.81	35.6	.558	1.000
28 Aug	1030	16.75	9.5	.80	36.0	.389	.697
28 Aug	1730	23.75	12.7	.80	36.0	.532	.955
29 Aug	0945	40.00	6.8	.88	36.0	.313	.560
31 Aug	1145	90.00	4.8	.85	36.8	.209	.375
2 Sept	0845	135.00	3.2	.85	35.0	.146	.262
3 Sept	1100	161.25	3.1	.85	34.6	.143	.256
4 Sept	1100	185.25	2.6	.84	34.3	.120	.215
8 Sept	1100	281.25	1.7	.90	28.6	.101	.181
9 Sept	1100	305.25	2.2	.90	28.0	.133	.238
16 Sept	0800	470.25	1.35	.92	30.2	.077	.138
17 Sept	1100	497.25	1.40	.91	31.8	.076	.136
18 Sept	1045	521.00	1.28	.90	33.5	.065	.1165
19 Sept	0845	543.00	1.55	.90	36.3	.072	.129
19 Sept	1000	544.25	1.54	.90	28.8	.091	.163
22 Sept	0900	615.25	0.98	.88	29.2	.056	.100
23 Sept	1130	641.75	1.02	.86	31.7	.052	.0932
24 Sept	1130	665.75	0.70	.95	23.5	.053	.0950
25 Sept	1130	689.75	0.68	.94	26.6	.045	.0806
25 Sept	Outage 2 hrs						
26 Sept	1145	714.0	0.55	.96	25.4	.039	.0699
28 Sept	Outage 10 hrs						
29 Sept	1630	780.75	0.44	.90	26.4	.028	.0501
30 Sept	1545	804.0	0.58	.90	26.5	.037	.0663
1 Oct	1645	827.0	0.40	.95	25.5	.028	.0501
3 Oct	0900	867.25	0.47	.96	28.5	.030	.0538
6 Oct	1700	947.25	1.33	.90	26.5	.085	.152
7 Oct	Outage 4.25 hrs						
8 Oct	1015	984.25	0.51	.89	27.5	.031	.0555
8 Oct	1630	990.5	0.72	.89	27.5	.044	.0789
9 Oct	1700	1015.0	0.56	.90	26.8	.035	.0627
10 Oct	1700	1039.0	0.67	.90	32.8	.035	.0627
12 Oct	Outage 10 hrs est.						
13 Oct	1645	1100.75	0.60	.95	27.3	.039	.0699
14 Oct	1645	1124.75	0.53	.95	25.5	.037	[illegible]
16 Oct	0900	1165.0	0.40	.99	27.2	.027	[illegible]
17 Oct	0930	1189.5	0.38	.98	27.0	.026	[illegible]
20 Oct	0930	1261.5	0.36	.99	25.7	.026	[illegible]
21 Oct	0900	1285.0	0.40	.99	26.5	.028	.0501
21 Oct	0930	1285.5	Permeameter reconnected to reverse flow				
21 Oct	1645	1292.75	4.25	.99	27.4	0.290	[illegible]
22 Oct	0915	1309.25	3.2	.975	27.3	.215	[illegible]

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
23 Oct	0830	1332	3.47	1.00	27.6	.237	.425
24 Oct	0930	1357	3.27	.99	27.3	.223	.400
27 Oct	0930	1429	1.75	1.00	27.0	.122	.219
28 Oct	0912	1453	1.70	.975	26.7	.117	.210
30 Oct	1030	1502	1.57	.97	27.7	.104	.186
31 Oct	0915	1525	1.47	1.00	26.9	.103	.185
5 Nov	1130	1647	1.06	.89	29.3	.0607	.109
6 Nov	1530	1675	0.90	.89	28.9	.0522	.0936
7 Nov	1630	1700	1.13	.90	33.4	.0574	.103
3 hour outage							
11 Nov	0830	1785	0.87	1.00	31.1	.0527	.0945
12 Nov	5 hour outage						
13 Nov	0845	1828	0.625	1.16	26.1	.0525	.0942
Outage 2 hours							
14 Nov	1500	1855	0.833	1.10	28.0	.0617	.1007
17 Nov	0910	1923	0.613	1.16	26.1	.0514	.0921
20 Nov	1000	1996	0.625	1.05	28.8	.0430	.0771
21 Nov	1630	2026	0.734	1.00	33.0	.0420	.0754
24 Nov	0900	2091	0.566	1.18	30.6	.0412	.0740
26 Nov	1430	2144	0.466	1.09	28.4	.0337	.0605
28 Nov	0900	2187	0.433	1.23	28.8	.0349	.0625
29 Nov	1300	2215	0.375	1.06	—	—	—
1 Dec	0830	2258	0.389	1.12	28.0	.0294	.0527
2 Dec	0800	2272	0.437	1.21	28.2	.0354	.0635
4 Dec	1445	2336	0.480	1.00	32.4	.0279	.0500
5 Dec	1630	2362	0.510	1.00	28.0	.0344	.0616
5 Dec	1650	2362	--	1.00	27.0	--	—
5 Dec '52	1700	Shut off until July 1953					
Start of Second Run - Continued Reversed Flow - no water treatment							
11 July '53	1530	2384	2.60	0.80	26.6	.147	.264
12 July	1340	2406	1.90	0.79	27.3	.104	.186
13 July	0800	2425	1.33	0.79	25.0	.0792	.142
14 July	0900	2450	1.16	0.79	28.0	.0617	.111
15 July	1445	2479	0.933	0.85	28.2	.0530	.0950
17 July	0930	2522	0.733	0.85	27.1	.0433	.0776
20 July	0800	2592	0.600	0.89	26.4	.0381	.0683
21 July	0930	2618	0.600	0.88	27.7	.0359	.0643
22 July	0900	2642	0.439	0.89	27.2	.0271	.0486
23 July	0915	2666	0.549	0.88	28.9	.0279	.0500
24 July	0900	2690	0.480	0.89	31.9	.0252	.0452
27 July	0930	2762	0.533	0.88	35.3	.0251	.0450
28 July	0930	2796	0.500	0.88	32.4	.0256	.0458
29 July	1000	2821	0.533	0.88	34.3	.0258	.0462
30 July	0900	2844	0.450	0.88	31.3	.0238	.0427
31 July	1000	2859	0.500	0.86	34.8	.0233	.0418
3 Aug	0930	2930	0.320	0.98	30.7	.0193	.0346
4 Aug	1000	2955	0.400	0.98	34.6	.0214	.0384
5 Aug	0900	2978	0.350	0.95	32.4	.0193	.0346
6 Aug	0930	3002	0.467	0.93	33.4	.0245	.0439
7 Aug	0930	3026	0.300	0.92	28.9	.0180	.0323
10 Aug	0930	3098	0.450	0.90	37.0	.0206	.0369

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
11 Aug	0930	3122	0.400	0.91	34.5	.0199	.0357
12 Aug	1000	3147	0.45	0.92	36.7	.0213	.0382
13 Aug	0930	3170	0.400	0.91	34.6	.0198	.0355
14 Aug	0900	3194	0.400	0.91	34.9	.0196	.0351
17 Aug	0900	3266	0.350	0.91	33.5	.0179	.0321
18 Aug	1400	3295	0.475	0.89	37.0	.0215	.0385
19 Aug	0930	3314	0.400	0.91	36.8	.0186	.0333
20 Aug	0900	3338	0.325	0.95	33.2	.0175	.0314
21 Aug	0900	3362	0.325	0.93	34.1	.0167	.0299
24 Aug	1000	3435	0.375	0.91	34.5	.0186	.0333
25 Aug	0830	3457	0.350	0.91	34.6	.0173	.0310
26 Aug	0900	3482	0.375	0.91	35.7	.0180	.0323
27 Aug	0930	3506	0.400	0.92	35.7	.0194	.0348
28 Aug	0900	3530	0.360	0.90	32.4	.0189	.0339
31 Aug	1230	3605	0.357	0.93	32.0	.0196	.0351
2 Sept	0930	3650	0.250	0.95	32.0	.0140	.0251
3 Sept	0900	3674	0.250	0.98	29.5	.0153	.0274
4 Sept	0900	3698	0.250	0.96	28.9	.0156	.0280
8 Sept	0900	3794	0.220	0.88	28.4	.0128	.0229
9 Sept	0900	3818	0.200	0.91	28.3	.0121	.0217
10 Sept	0900	3842	0.213	0.93	27.4	.0136	.0244
11 Sept	0900	3866	0.288	0.90	34.8	.0140	.0251
16 Sept	1145	3988	0.190	0.93	27.1	.0123	.0220
18 Sept	1000	4035	0.185	0.95	26.6	.0124	.0222
21 Sept	0900	4106	0.20	1.08	27.5	.0138	.0247
22 Sept	0900	4130	0.178	1.08	26.3	.0129	.0231
23 Sept	0930	4154	0.20	1.09	27.6	.0138	.0247
24 Sept	0930	4178	0.189	1.01	27.6	.0130	.0199
25 Sept	0930	4202	0.155	1.01	26.5	.0111	.0199
28 Sept	0820	4273	0.166	1.04	29.8	.0109	.0195
29 Sept	0820	4297	0.111	1.02	25.5	.00836	.0150
30 Sept	1330	4326	0.144	1.01	26.5	.0103	.0185
1 Oct	1220	Acid plus Cl_2 Treatment Begins					
2 Oct	1215	4374	0.316	1.00	30.0	.0198	.0355
2 Oct	1000	4383	0.428	1.01	26.8	.0304	.0545
5 Oct	1500	4448	8.33	0.78	13.4	.914	1.64
6 Oct	0830	4465	14.0	0.89	25.3	.928	1.66
7 Oct	0820	4489	16.0	0.92	23.2	1.19	2.13
8 Oct	0845	4513	15.8	.95	23.1	1.22	2.14
9 Oct	0845	4537	15.0	.98	24.6	1.12	2.01
12 Oct	0845	4609	15.0	.98	26.0	1.06	1.90
13 Oct	0820	4633	3.43	1.02	21.9	0.301	0.54
14 Oct	0830	4657	190	1.06	26.8	14.1	25.3
15 Oct	0845	4681	158	1.08	26.0	12.4	22.2
16 Oct	0830	4705	155	1.08	26.2	12.0	21.5

Outage 59 hours

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_0
19 Oct	0845	4709	162	1.08	24.5	13.5	24.2
20 Oct	0830	4742	168	1.08	28.9	11.8	21.2
21 Oct	1200	4757	159	1.04	26.9	11.8	21.2
22 Oct	1200	4795	147	1.00	24.2	11.4	20.4
23 Oct	1500	4820	172	1.00	19.2	16.9	30.3
	Outage 48 hours						
26 Oct	0830	4838	183	1.01	26.7	13.1	23.5
27 Oct	0800	4861	168	1.00	28.2	11.2	20.1
28 Oct	1130	4889	179	.91	27.9	11.0	19.7
29 Oct	0800	4909	167	.96	27.9	10.8	19.3
30 Oct	1200	4937	158	1.00	26.9	11.1	19.9
	Outage 24 hours						
3 Nov	1200	5009	225	1.05	27.9	16.0	28.7
4 Nov	0800	5029	212	1.08	26.5	16.3	29.2
	Outage 12 hours						
5 Nov	1700	5050	180	1.06	25.2	14.3	25.6
6 Nov	0930	5067	178	1.10	24.9	14.8	26.5
9 Nov	1630	5146	219	.95	25.7	15.2	27.2
10 Nov	0830	5163	227	.98	28.0	15.0	26.9
11 Nov	1130	5190	70	.95	28.9	4.34	7.78
12 Nov	1230	5215	34.7	1.04	25.2	2.69	4.82
13 Nov	1100	5238	90	1.08	31.4	5.83	9.91
16 Nov	1100	5310	55.7	1.02	30.3	3.53	6.32
17 Nov	0800	5329	48.3	1.06	26.4	3.66	6.66
18 Nov	1130	5357	57	1.10	28.1	4.20	7.53
19 Nov	0830	5378	63.3	1.10	31.9	4.12	7.38
20 Nov	1100	5404	61.7	1.10	30.4	4.20	7.53
23 Nov	0930	5475	65	1.10	25.8	5.22	9.36
24 Nov	1200	5501	61.3	1.06	25.7	4.76	8.53
25 Nov	1440	5528	70	.93	27.6	4.45	7.97
27 Nov	1130	5573	41.3	.95	28.7	2.57	4.60
30 Nov	1100	5644	28.3	.95	25.4	1.99	3.57
1 Dec	1200	5657	29.3	1.01	29.7	1.88	3.37
2 Dec	1200	5681	45	1.04	30.2	2.92	5.23
3 Dec	1600	5705	53.7	1.05	26.6	3.99	7.15
4 Dec	0930	5729	51.7	1.06	28.8	3.58	6.42
7 Dec	0830	5954	56.6	1.10	30.4	3.86	6.92
8 Dec	1030	5979	58.3	1.14	29.6	4.23	7.58
9 Dec	0830	6001	61.3	1.08	29.3	4.26	7.63
10 Dec	1200	6029	69.7	1.01	29.3	4.53	8.12
11 Dec	0830	6049	54.0	.98	32.2	3.10	5.56
14 Dec	1100	6124	56.2	1.01	29.1	3.78	6.77
15 Dec 1953	1230	6149	55.3	.96	28.7	3.48	6.24
	Acid plus chlorine off						
4 Jan 1954	1200	6629	4.50	1.02	30.4	.285	.511
5 Jan	1200	6653	4.00	1.01	31.4	.243	.435
6 Jan	1100	6676	4.30	.98	33.2	.239	.428
7 Jan	1200	6701	4.40	.98	33.1	.245	.439

Table 4. Group III, Permeameter Data

Well C-4, Sample No. 21

Depth 208 Feet.

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
7 Oct 1952	1006	0	216	.89	19.0	18.5	1.000
7 Oct	1012	0.1	196	.89	19.0	16.8	.909
	Outage, 4.25 hours						
7 Oct	1700	0.55	215	.89	21.0	16.6	.895
8 Oct	1030	20.15	136	.89	24.5	9.04	.488
8 Oct	1630	26.15	112	.89	24.1	7.57	.409
9 Oct	1630	50.15	109	.90	24.5	7.33	.396
10 Oct	Outage 9.65 hours est.						
10 Oct	1700	65.0	110	.90	31.8	5.70	.308
11 Oct	Outage 10 hours est.						
11 Oct	1300	75	23.5	.92			
12 Oct	Outage 10 hours est.						
13 Oct	1645	126.75	78	.95	26.2	5.17	.280
14 Oct	1000	Changed to 10 cm. Hg head					
14 Oct	1645	140.75	21.2	.95	10.0	3.68	.199
16 Oct	0900	181.0	21.8	.99	11.5	3.43	.185
17 Oct	0900	205	22.2	.98	11.0	3.62	.196
17 Oct	1100	207	37.5	.98	10.0	6.72	.364
20 Oct	0930	277.5	26.8	.99	11.2	4.33	.234
21 Oct	0845	300.75	24.3	.99	10.1	4.35	.235
22 Oct	0900	325	30.3	.975	10.7	5.05	.273
23 Oct	0815	348.25	31.8	1.00	11.4	5.10	.276
24 Oct	0915	373.25	30.5	.99	11.8	4.68	.253
27 Oct	0930	445.5	26.0	1.00	9.0	5.29	.286
28 Oct	0912	469.2	26.6	.975	9.5	5.00	.270
29 Oct	0900	493	24.5	.970	12.6	3.45	.186
30 Oct	1000	518	28.6	.970	8.75	5.80	.314
31 Oct	0915	541.25	29.2	1.00	8.0	6.68	.361
5 Nov	1120	663.3	39.8	.89	13.3	4.88	.264
6 Nov	1525	691.4	38	.89	13.7	4.51	.244
7 Nov	1630	716.5	45.7	.90	15.2	4.94	.267
	Outage 3 hours						
11 Nov	0820	801.3	42.0	1.00	16	4.81	.260
13 Nov	0845	849.8	29.3	1.03	15.1	3.66	.198
	Outage 2 hours						
14 Nov	1500	878	31.3	1.015	16.3	3.57	.193
17 Nov	0910	944.2	15.3	1.09	11.7	2.61	.141
20 Nov	1000	1017	16.6	1.00	15.4	1.97	.1065
21 Nov	1630	1047.5	21	.95	14.7	2.48	.134
24 Nov	0900	1112	19.1	1.10	14.6	2.63	.142
24 Nov	0945	1112.8	Raised pressure to maximum				
26 Nov	1430	1165.5	58.5	1.03	27.5	4.13	.223
28 Nov	0900	1208	46	1.12	26.7	3.53	.191
28 Nov	0910	1208.2	41.6	1.12	26.7	3.19	.172

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
29 Nov	1300	1236	46	1.03	27.8	3.12	.168
29 Nov	Changed to acid plus chlorine treatment						
1 Dec	0830	1279	45.4	1.00	27	3.08	.166
2 Dec	0800	1303	66	1.09	27.1	4.85	.262
4 Dec	1445	1357	5.64	1.00	2.3	4.48	.242
5 Dec	1630	1383	3.88	1.00	1.6	4.43	.239
5 Dec	1650	1383	102	1.00	22.5	8.3	.448
5 Dec 1952	1700	Shut off until Sept 24, 1953					
24 Sept 1953	1400	1384	109	1.01	25.4	7.92	.428
25 Sept	1430	1408	74.3	.96	26.5	4.92	.266
28 Sept	0830	1475	42.5	1.04	30.4	2.66	.144
29 Sept	0820	1498	29.7	1.01	26.8	2.05	.111
30 Sept	0810	1522	28.0	1.04	26.9	1.98	.107
1 Oct	0940	1548	27.2	1.02	26.9	1.88	.102
2 Oct	1215	1574	35.3	.96	29.2	2.12	.114
5 Oct	1400	1648	25.0	.77	27.6	1.28	.0692
6 Oct	0830	1667	28.0	.88	26.4	1.70	.0918
7 Oct	0820	1690	20.5	.91	26.0	1.31	.0708
8 Oct	0845	1716	16.9	.95	26.5	1.11	.0600
9 Oct	0845	1739	15.4	.98	27.0	1.02	.0551
12 Oct	0845	1811	11.6	.98	27.5	.755	.0408
13 Oct	0815	1834	10.0	1.04	26.8	.709	.0383
14 Oct	0830	1859	9.5	1.04	27.3	.662	.0358
15 Oct	0845	1884	7.5	1.05	26.9	.535	.0289
16 Oct	0830	1907	6.2	1.04	26.9	.438	.0237
19 Oct	0845	1979	3.7	1.06	25.8	.278	.0150
20 Oct	0830	2002	4.9	1.04	31.4	.297	.0161
21 Oct	1200	2030	4.0	1.02	28.2	.264	.0143
22 Oct	1200	2054	2.9	1.02	25.1	.215	.0116
23 Oct	1500	2077	2.6	1.02	22	.220	.0119
26 Oct	0830	2147	4.1	.98	28.3	.260	.0140
27 Oct	0800	2170	4.3	.98	28.4	.272	.0147
28 Oct	1130	2198	5.0	.91	28.5	.292	.0158
30 Oct	1200	2246	4.3	.93	27.6	.265	.0143
	Outage 62 hours						
5 Nov	0900	2316	4.6	1.01	26.5	.321	.0173
6 Nov	1130	2342	4.3	1.04	27.8	.294	.0159
9 Nov	1630	2419	5.2	.90	28.0	.306	.0165
10 Nov	0830	2434	4.6	.95	26.8	.298	.0161
	Outage 170 hours						
18 Nov	1145	2460	5.3	1.05	32.9	.309	.0167
19 Nov	0830	2481	6.5	1.06	33.7	.374	.0202
20 Nov	1100	2507	5.3	1.05	31.4	.324	.0175
23 Nov	0930	2578	3.2	1.06	26.6	.233	.0126
24 Nov	1100	2603	3.3	1.02	27.0	.228	.0123
25 Nov	1440	2631	4.1	.92	28.2	.245	.0132

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
27 Nov	1130	2676	5.2	.93	29.7	.298	.0161
30 Nov	1100	2747	4.5	.93	26.7	.287	.0155
1 Dec	1200	2772	6.5	.96	30.9	.369	.0199
2 Dec	1200	2796	6.4	1.01	31.2	.379	.0205
3 Dec	1600	2824	4.9	1.00	27.8	.323	.0175
4 Dec	0930	2842	4.8	1.02	29.8	.300	.0162
7 Dec	0830	2913	4.25	1.06	31.6	.276	.0144
8 Dec	1030	2939	3.94	1.06	30.7	.265	.0143
9 Dec	0830	2961	4.10	1.06	30.5	.276	.0149
10 Dec	1200	2988	4.13	.96	30.4	.254	.0137
11 Dec	0830	3009	5.47	.93	34.1	.290	.0157
14 Dec	1100	3083	4.73	.96	30.5	.272	.0147
15 Dec	1230	3109	4.32	.93	30.1	.245	.0133
16 Dec	1200	3132	4.27	.95	30.2	.246	.0133
17 Dec	1200	3156	4.40	.93	33.2	.226	.0122
18 Dec	1200	3180	4.53	.96	33.1	.240	.0130
4 Jan 1954	1200	3588	3.83	1.02	32.7	.219	.0118
5 Jan	1200	3612	3.67	1.01	32.3	.210	.0114
6 Jan	1100	3635	3.77	.98	33.2	.204	.0110
17 June	1600	3635	65.9	.90	27.7	3.92	.212
17 June	1630	3635.5	50.9	.90	25.1	3.34	.181
18 June	0930	3652	40.8	.92	27.2	2.52	.136
18 June	1230	3655	38.0	.89	26.0	2.38	.129
18 June	1500	3658	77.5	.89	25.1	5.03	.272
19 June	1220	3679	36.2	.89	26.7	2.21	.120
21 June	1100	3726	19.7	.92	26.7	1.24	.0671
22 June	1330	3752	16.5	.92	25.8	1.07	.0579
23 June	0845	3772	15.0	.93	26.0	.98	.0530
24 June	1410	3801	11.5	.88	26.5	.698	.0378
25 June	0830	3819	13.5	.91	34.5	.652	.0353
27 June	1345	3873	9.54	.88	35.4	.434	.0235
29 June	0900	3916	6.80	.90	28.1	.398	.0215
30 June	0830	3939	5.0	.90	30.1	.273	.0148
2 July	0930	3989	4.2	.90	30.7	.225	.0122
5 July	1600	4067	2.67	.83	25.9	.157	.00849
6 July	0830	4083	2.40	.89	25.1	.156	.00843
7 July	1020	4109	3.30	.90	24.3	.224	.0121
9 July	1700	4164	4.80	.79	24.6	.282	.0152
11 July	1600	4211	5.40	.80	25	.316	.0171
12 July	0900	4228	3.45	.85	24.9	.215	.0116
14 July	1030	4277	2.31	.84	25.1	.141	.00763
16 July	1430	4330	3.40	.74	26.3	.175	.00947
19 July	1430	4353	4.37	.75	25.6	.234	.0127
19 July	1650	4404	3.17	.77	22.9	.195	.0105
20 July	1030	4421	4.90	.79	39	.181	.00979
22 July	0945	4469	2.80	.85	26.9	.162	.00876
25 July	1700	4548	2.18	.85	26.3	.129	.00698
29 July	0900	4636	2.50	.85	27.8	.140	.00757
30 July	1645	4668	2.50	.75	27.0	.127	.00687

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
3 Aug	1430	4762	1.40	.85	25.9	.0841	.00455
4 Aug	0930	4781	1.40	.88	27.5	.0820	.00444
5 Aug	0830	4804	1.30	.89	25.4	.0833	.00451
9 Aug	1330	4904	1.07	.90	23.9	.0738	.00399
11 Aug	1430	4953	1.10	.90	23.8	.0760	.00411
13 Aug	1715	5004	1.07	.89	23.5	.0742	.00401
16 Aug	0900	5068	1.00	.91	22.8	.0730	.00395
17 Aug	0800	5091	1.80	.96	20.7	.153	.00828
18 Aug	0900	5116	1.67	.96	20.8	.141	.00763
22 Aug	2100	5164	1.17	.86	23.1	.0797	.00431
24 Aug	2200	5173	1.07	.91	26.8	.0665	.00360

Table 5. Group II, Permeameter Data

Well C-12, Sample No. 20

Depth 200 Feet.

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_c
23 Sept 1952	1645	0	22.0	.86	23.0	1.45	1.000
24 Sept	1130	18.75	11.9	.95	20.3	.985	.679
25 Sept	1130	42.75	10.8	.935	26.5	.675	.465
	Outage 2 hours						
26 Sept	1145	67	8.7	.96	22.4	.660	.455
28–29 Sept	Outage 10 hours est.						
29 Sept	1630	133.75	13.9	.90	26.0	.851	.589
30 Sept	1545	157.0	10.9	.90	26.0	.667	.460
1 Oct	1645	182.0	7.8	.95	25.0	.525	.362
3 Oct	0900	222.25	9.8	.96	28.0	.595	.410
6 Oct	1700	302.25	8.0	.90	26.0	.490	.338
7 Oct	Outage 4.25 hours						
8 Oct	1015	339.25	9.3	.89	27.0	.542	.374
8 Oct	1630	345.5	9.3	.89	27.0	.542	.374
9 Oct	Outage, 1 day and 3.5 hours						
10 Oct	1700	366.5	17.0	.90	32.0	.848	.585
12 Oct	Outage, 10 hours est.						
13 Oct	1645	428.25	6.1	.95	27.0	.380	.262
14 Oct	1645	452.25	4.95	.95	24.7	.337	.232
16 Oct	0900	492.5	4.0	.99	23.5	.298	.205
1[illegible]	0930	517.0	4.0	.98	23.5	.295	.203
2[illegible]	0930	590	3.9	.99	23.5	.291	.201
21 Oct	0900	612.5	4.4	.99	24.0	.321	.221
22 Oct	0915	636.75	4.1	.975	25.2	.281	.194
23 Oct	0830	660	4.58	1.00	25.3	.320	.220
24 Oct	0930	685	4.16	.99	23.7	.307	.212
27 Oct	0930	755	4.6	1.00	25.9	.315	.217
28 Oct	0912	778.7	4.3	.975	24.2	.307	.212
29 Oct	0900	802.5	3.2	.970	23.9	.261	.180
30 Oct	1000	827.5	3.62	.970	26.1	.238	.164
31 Oct	0915	850.75	3.46	1.00	25.4	.241	.166
	Outage 22 hours						
5 Nov	1130	951	4.30	.89	26.3	.258	.178
	Outage 1.5 hours						
6 Nov	1530	977.5	5.20	.89	27.3	.300	.207
	Outage 6 hours						
7 Nov	1630	996.5	7.06	.90	31.2	.360	[illegible]
	Outage, 3 hours						
11 Nov	0830	1081.5	3.46	1.00	29.2	.210	[illegible]
13 Nov	0845	1129.8	7.30	1.03	25.1	.530	[illegible]
	Outage, 2 hours						

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm,Hg)	Permeability (ft/day)	P/P_o
14 Nov	1500	1158	5.13	1.015	26.0	.355	.245
17 Nov	0910	1224	4.13	1.09	25.8	.309	.213
20 Nov	1000	1297	4.75	1.00	28.3	.297	.205
21 Nov	1630	1327	5.87	.95	30.4	.325	.224
24 Nov	0900	1392	4.20	1.10	28.7	.285	.196
26 Nov	1430	1445	3.63	1.03	26.2	.252	.174
28 Nov	0900	1468	3.60	1.12	27.3	.261	.180
29 Nov	1300	1516	4.00	1.03	28.0	.260	.179
1 Dec	Treatment changed to acid plus chlorine						
1 Dec	0830	1559	3.05	1.00	27.6	.196	.135
2 Dec	0800	1583	6.25	1.09	26.6	.453	.313
4 Dec	1445	1637	9.28	1.00	31.0	.530	.365
5 Dec	1630	1663	6.75	1.00	26.6	.450	.310
5 Dec	1650	1663	6.40	1.00	24.5	.463	.319
5 Dec	1700 Shut off						

Table 6. Group IV, Permeameter Data
Well D, Sample No. 28,
Depth 198 Feet.

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
Start of Third Run - Water De-aerated and filtered							
5 July 1954	1750	0	90	.83	25.3[illegible]	5.59	1.0[illegible]
6 July	0900	15.2	85	.89	31.0	4.60	.82
7 July	1000	40	22.7	.84	24.4	1.47	.26
8 July	1655	71	8.4	.77	23.8	.513	.09[illegible]
9 July	1710	95	8.0	.79	23.3	.511	.09[illegible]
12 July	0900	157	3.5	.85	24.3	.230	.04[illegible]
13 July	0900	183	3.0	.85	25.0	.192	.03[illegible]
14 July	1030	208	1.07	.84	24.4	.0694	.012
15 July	1645	239	2.20	.74	25.2	.117	.02[illegible]
16 July	1425	260	2.00	.77	26.2	.111	.01[illegible]
17 July	1500	285	1.80	.77	25.0	.104	.01[illegible]
19 July	1650	335	1.27	.77	23	.0801	.01[illegible]
20 July	1015	352	.90	.80	23.1	.0588	.01[illegible]
21 July	1615	382	.80	.84	23.8	.0532	.0095
22 July	0945	400	.91	.84	26.4	.0547	.009[illegible]
25 July	1700	479	.91	.83	26.2	.0543	.009[illegible]
29 July	0900	567	1.10	.83	27.5	.0626	.0112
30 July	1630	598	1.10	.77	25.6	.0624	.0112
3 Aug	1430	692	.90	.85	26.1	.0552	.009[illegible]
4 Aug	0930	712	.50	.88	27.4	.0303	.005[illegible]
5 Aug	0830	734	.40	.88	25.4	.0262	.0047
9 Aug	1330	836	.33	.90	23.7	.0236	.0042
11 Aug	1430	884	.33	.91	23.5	.0241	.00[illegible]
13 Aug	1700	935	.33	.90	23.3	.0239	.004[illegible]
16 Aug	0900	997	.31	.96	22.3	.0251	.004[illegible]
17 Aug	0800	1022	.27	.96	20.3	.0241	.00[illegible]
18 Aug	0900	1047	.33	.96	20.5	.0242	.005[illegible]
22 Aug	2100	1155	.33	.86	22.9	.0234	.004[illegible]
24 Aug	2200	1204	.33	.91	26.4	.0215	.00[illegible]

Table 7. Group I[illegible]. Permeameter Data,
Well E-1. Sample No. 12,
Depth 158 Feet.

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
12 Sept	1100	0	28.6	.98	20.3	2.52	1.000
15 Sept	1030	71.5	12.0	.90	32.0	.617	.245
16 Sept	0830	93.0	7.3	.92	26.8	.458	.182
17 Sept	1100	120	7.9	.91	30.5	.431	.171
18 Sept	1045	143	7.1	.90	33.5	.349	.1385
19 Sept	0930	166	5.8	.90	26.1	.366	.145
22 Sept	0900	238	4.1	.88	29.2	.226	.0896
23 Sept	1130	264	4.2	.86	31.4	.210	.0834
24 Sept	1130	288	3.15	.95	22.3	.246	.0976
25 Sept	1130	312	3.64	.94	27.0	.232	.0920
	Outage 2 hours						
26 Sept	1145	336	3.45	.96	24.0	.253	.1005
28 Sept	Outage 10 hours est.						
29 Sept	1630	403	4.45	.90	26.2	.280	.111
30 Sept	1545	426	3.8	.90	26.8	.233	.0925
1 Oct	1645	443	3.8	.95	25.5	.252	.103
3 Oct	0900	492	2.05	.96	28.5	.126	.0500
6 Oct	1700	572	4.2	.90	26.5	.261	.1035
7 Oct	Outage 4.25 hours						
8 Oct	1015	609	3.85	.89	26.4	.237	.0941
8 Oct	1630	615	4.05	.89	27.6	.239	.0950
8 Oct	1645	639	3.72	.90	26.8	.229	.0910
10 Oct	1700	663	5.25	.90	32.5	.266	.1055
12 Oct	Outage 10 hours est.						
13 Oct	1645	725	4.3	.95	27.3	.274	.109
14 Oct	1645	749	3.7	.95	25.5	.252	.100
16 Oct	0900	789.75	3.1	.99	27.1	0.207	.0821
17 Oct	0930	814	3.0	.98	26.9	.200	.0795
20 Oct	0930	886	2.3	.99	25.1	.166	.0660
21 Oct	0900	909	2.4	.99	26.5	.164	.0651
22 Oct	0915	934	2.4	.98	26.8	.160	.0635
23 Oct	0830	957	2.22	1.00	25.8	.157	.0624
24 Oct	0930	980	2.05	.99	26.5	.140	.0556
27 Oct	0930	1052	2.0	1.00	26.5	.138	.0598
28 Oct	0912	1075	1.8	.975	26.4	.121	.0480
29 Oct	1045	1101	1.77	.97	26.5	.118	.0469
30 Oct	1000	1124	1.69	.97	27.3	.110	.0437
31 Oct	0915	1148	1.63	1.00	26.5	.1125	.0447
5 Nov	1130	1260	1.52	.89	28.8	.0859	.0341
6 Nov	1530	1298	1.33	.89	28.5	.0759	.0301
7 Nov	1630	1323	1.58	.90	32.3	.0805	.0319
	Outage 3 hours						
11 Nov	0830	1409	1.07	1.00	31.5	.0621	.0247
11 Nov	1400	1414	Discontinued				

Table 8. Group IV, Permeameter Data

Well F, Sample No. 16,

Depth 149 Feet.

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
	Start of Third Run - Water de-aerated and filtered						
2 July 1954	0955	0	140	.84	20.3	12.6	1.00
2 July	1710	7.3	190	.84	24.9	11.3	.87
5 July	1625	78.5	65	.79	25.3	3.82	.294
6 July	0900	95	64	.89	26.6	3.79	.292
7 July	1000	120	27	.81	18.7	2.07	.159
8 July	1555	151	35	.79	24.2	2.02	.155
9 July	1710	175	26	.79	23.8	1.53	.118
12 July	0900	239	13	.85	25.0	0.782	.0602
13 July	0900	263	11.5	.85	25.3	.683	.0525
14 July	1030	288	6.8	.83	24.3	.411	.0316
15 July	1645	319	8.1	.70	25.3	.397	.0305
16 July	1430	341	9.0	.71	26.2	.432	.0333
17 July	1500	365	8.4	.77	25.0	.458	.0352
19 July	1650	415	7.1	.77	23	.420	.0323
20 July	1015	432	5.90	.79	23	.359	.0276
21 July	1615	462	5.30	.81	25.3	.300	.0231
22 July	0945	480	5.09	.84	26.5	.285	.0219
25 July	1700	559	4.00	.81	26.5	.216	.0166
28 July	1330	627	4.00	.77	26.3	.207	.0159
29 July	0900	647	5.20	.83	27.4	.279	.0215
30 July	1630	678	4.80	.76	25.5	.253	.0195
3 Aug	1430	772	2.70	.85	26.0	.156	.0120
4 Aug	0930	792	2.50	.88	27.4	.142	.0109
5 Aug	0830	814	2.40	.89	25.5	.148	.0114
9 Aug	1330	915	1.87	.90	24.1	.124	.00954
11 Aug	1430	964	1.87	.89	23.6	.125	.0096
13 Aug	1715	1015	1.80	.88	23.4	.120	.0092
16 Aug	0900	1079	1.78	.91	22.5	.127	.0098
17 Aug	0800	1102	3.00	.96	20.5	.250	.0192
18 Aug	0900	1127	3.00	.97	20.6	.250	.0192
22 Aug	2100	1235	1.93	.86	23.1	.127	.0098
24 Aug	2200	1284	1.73	.91	26.5	.105	.0081

Table 9. Group I, Permeameter Data

Well F. Sample No. 24,

Depth 159 Feet.

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
12 Nov 1952	1145	0	129	1.05	27.6	9.24	1.000
12 Nov	1150	.05	130	1.05	27.6	9.31	1.008
12 Nov	1155	.15	146	1.05	27.6	10.48	1.132
12 Nov	1530	3	182	1.05	27.6	13.05	1.41
13 Nov	0840	21	126	1.16	26.0	10.6	1.147
	Off 2 hours						
14 Nov	1530	49	44.4	1.10	10.7	8.60	.930
17 Nov	0910	115	30.8	1.16	15.3	4.40	.476
20 Nov	1000	188	33.2	1.05	16.9	3.89	.420
21 Nov	1630	218	36.7	1.00	19.1	3.62	.392
24 Nov	0900	283	29.2	1.18	19.8	3.28	.355
	0950	284					
26 Nov	1430	336	42.4	1.09	28.2	3.09	.334
28 Nov	0900	379	31.7	1.23	27.6	2.66	.288
29 Nov	1300	407	28.5	1.06	28	2.04	.221
1 Dec	0830	450	28.8	1.12	28	2.17	.235
2 Dec	0800	474	23.9	1.21	28.6	1.91	.207
4 Dec	1445	529	22.3	1.00	31.6	1.33	.144
5 Dec	1630	554	14.3	1.00	27.4	.985	.1065
5 Dec	1650	555	14.4	1.00	26.9	1.01	.1092
5 Dec	1700 Shut off until July 10, 1953						
10 July 1953	Start of second run - no water treatment						
11 July	1530	576	17.1	.76	27.7	.858	.0928
12 July	1340	599	11.8	.76	27.6	.858	.0928
13 July	0800	617	7.86	.79	26.3	.432	.0467
14 July	0900	642	11.8	.79	28.9	.590	.0638
15 July	1445	672	8.07	.80	29.2	.404	.0437
16 July	0845	690	7.89	.83	28.6	.419	.0453
17 July	0930	714	7.07	.83	28.4	.378	.0408
20 July	0800	785	5.60	.89	27.6	.330	.0357
21 July	0930	810	6.06	.86	29.2	.326	.0342
22 July	0900	834	4.68	.86	28.4	.259	.0280
23 July	0915	858	4.90	.86	30.6	.252	.0273
24 July	0900	882	4.87	.86	36.9	.208	.0225
27 July	0930	954	5.80	.89	36.5	.258	.0279
28 July	0930	988	4.55	.86	34.0	.206	.0223
29 July	1000	1013	4.53	.86	35.4	.201	.0217
30 July	0900	1036	4.20	.86	32.7	.202	.0218
31 July	1000	1051	4.50	.83	35.9	.190	.0205
3 Aug	0930	1122	2.64	.95	32.0	.143	.0155
4 Aug	1000	1147	2.65	.95	36.1	.128	.0138
5 Aug	0900	1170	2.35	.93	33.4	.120	.0130
6 Aug	0930	1194	2.27	.93	34.6	.112	.0121
7 Aug	0930	1218	1.85	.91	30.1	.102	.0110

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
10 Aug	0930	1290	2.20	.89	38.9	.0921	.00996
11 Aug	0930	1314	1.80	.89	35.4	.0828	.00895
12 Aug	1000	1339	1.80	.91	37.8	.0793	.00858
13 Aug	0930	1362	1.65	.89	35.5	.0757	.00818
14 Aug	0900	1386	1.40	.89	35.1	.0650	.00703
17 Aug	0900	1458	1.25	.89	34.6	.0588	.00636
18 Aug	1400	1487	1.325	.86	38.2	.0546	.00590
19 Aug	0930	1506	1.18	.89	37.9	.0507	.00548
20 Aug	0900	1530	1.05	.93	34.1	.0523	.00566
21 Aug	0900	1554	1.00	.91	35.3	.0572	.00619
24 Aug	1000	1627	1.20	.89	35.5	.0550	.00595
25 Aug	0830	1649	.975	.89	35.8	.0443	.00479
26 Aug	0900	1674	.95	.89	36.7	.0422	.00456
27 Aug	0930	1698	.90	.89	36.8	.0398	.00430
28 Aug	0900	1722	.84	.89	33.5	.0408	.00442
31 Aug	1250	1797	.787	.91	35.0	.0375	.00405
2 Sept	0930	1842	.60	.93	35.1	.0291	.00315
3 Sept	0900	1866	.55	.95	30.2	.0317	.00343
4 Sept	0900	1890	.50	.93	30.1	.0283	.00306
8 Sept	0900	1986	.50	.89	29.3	.0278	.00300
9 Sept	0900	2010	.45	.89	29.3	.0250	.00270
10 Sept	0900	2034	.45	.91	28.4	.0264	.00285
11 Sept	0900	2058	.525	.86	36.2	.0228	.00247
16 Sept	1415	2181	.38	.91	26.4	.0239	.00258
18 Sept	1000	2227	.288	.91	27.5	.0174	.00188
21 Sept	0900	2298	.356	.98	28.7	.0222	.00240
22 Sept	0900	2322	.311	.98	26.8	.0208	.00225
23 Sept	0930	2346	.356	.98	28.8	.0221	.00239
24 Sept	0930	2370	.356	.98	28.6	.0223	.00241
25 Sept	0930	2394	.322	.98	27.8	.0208	.00225
28 Sept	0820	2465	.378	1.01	30.9	.0226	.00244
29 Sept	0820	2489	.300	.98	26.5	.0203	.00219
30 Sept	1330	2518	.334	.96	27.5	.0213	.00230
1 Oct	Acid plus chlorine treatment begins						
2 Oct	1215	2565	1.82	.96	30.9	.103	.0111
2 Oct	2200	2575	7.38	.95	27.3	.469	.0508
5 Oct	1500	2640	40.0	.77	14.7	3.83	.414
6 Oct	0830	2657	116.5	.89	24.6	7.70	.833
7 Oct	0820	2681	390	.92	22.8	28.8	3.11
8 Oct	0845	2706	335	.95	23.4	24.9	2.69
9 Oct	0845	2730	266	.98	25.6	18.7	2.02
12 Oct	0845	2802	277	.98	26.0	19.1	2.06
13 Oct	0820	2825	27.5	1.02	21.8	2.36	.255
14 Oct	0830	2849	60	1.06	26.8	4.34	.469
15 Oct	0845	2847	143	1.08	26.5	10.6	1.15
16 Oct	0830	2897	119	1.08	26.8	8.77	.948
		Outage 59 hours					
19 Oct	0845	2902	129	1.08	25.0	10.5	1.14
20 Oct	0830	2934	242	1.08	29.4	16.8	1.82
21 Oct	1200	2950	168	1.04	26.9	11.9	1.29

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
22 Oct	1200	2986	147	1.0	24.2	11.1	1.20
23 Oct	1500	3013	305	1.0	19.2	29.0	3.14
	Outage 48 hours						
26 Oct	0830	3030	325	1.01	27.2	22.0	2.38
27 Oct	0800	3054	101	1.0	28.7	6.44	[illegible]
28 Oct	1130	3081	103	.91	28.4	6.04	.753
29 Oct	0800	3102	102	.96	28.4	6.31	[illegible]
30 Oct	1200	3130	99	1.0	27.4	6.62	[illegible]
3 Nov	Outage 24 hours						
3 Nov	1200	3202	102	1.05	28.4	6.89	[illegible]
4 Nov	0800	3222	80	1.08	27.0	5.85	[illegible]
	Outage 12 hours						
5 Nov	1700	3243	11	1.06	25.7	.83	[illegible]
6 Nov	0930	3259	9	1.10	25.4	.71	[illegible]
9 Nov	1630	3338	11	.95	26.2	.73	[illegible]
10 Nov	0830	3355	8	.98	28.5	.50	.0541
11 Nov	1130	3382	141	.95	29.4	8.33	.901
12 Nov	1230	3407	39	1.04	25.7	2.94	.318
13 Nov	1100	3431	47	1.08	31.9	2.91	.315
16 Nov	1100	3503	53.3	1.02	30.8	3.23	.350
17 Nov	0800	3522	45.7	1.06	26.9	3.30	.357
18 Nov	1130	3549	53	1.10	28.6	3.73	.403
19 Nov	0830	3570	55.7	1.10	32.4	3.46	.374
20 Nov	1100	3597	49.7	1.10	30.9	3.24	.350
23 Nov	0930	3667	55.5	1.10	26.3	4.24	.459
24 Nov	1200	3694	44.7	1.06	26.2	3.31	.359
25 Nov	1540	3720	45.7	.93	28.1	2.77	.300
27 Nov	1130	3765	46.7	.95	29.2	2.78	.301
30 Nov	1100	3837	40.3	.95	25.9	2.70	.292
1 Dec	1200	3850	46	1.01	30.2	2.81	.304
2 Dec	1200	3874	49.7	1.04	30.7	3.08	.333
3 Dec	1600	3898	50.7	1.05	27.1	3.60	.389
4 Dec	0930	3922	56.3	1.06	29.3	3.72	.402
7 Dec	0930	4146	53.7	1.10	30.9	3.50	.378
8 Dec	1030	4171	53.0	1.14	30.1	3.69	.399
9 Dec	0830	4193	52.7	1.08	29.9	3.48	.376
10 Dec	1200	4221	51.3	1.01	29.8	3.18	.344
11 Dec	0830	4241	59.7	.98	32.7	3.27	.353
14 Dec	1100	4316	368	1.01	29.6	23.0	.249
15 Dec	1230	4341	396	.96	29.2	23.8	.247
4 Jan 1954	1200	4821	580	1.02	30.9	35.0	3.78
5 Jan	1200	4845	556	1.01	31.9	32.3	3.49

Table 10. Group I, Permeameter Data

Well F-G, Sample No. 13,

Depth 141 Feet.

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
14 Nov 1952	0930	0.0	44.0	1.10	27.7	3.29	1.000
14 Nov	0935	0.1	48.0	1.10	27.7	3.59	1.091
14 Nov	0940	0.2	46.0	1.10	27.7	3.44	1.048
14 Nov	1125	1.9	36.6	1.10	27.7	2.74	0.834
14 Nov	1445	5.3	28.8	1.10	27.9	2.14	0.651
14 Nov	1645	7.3	26.4	1.10	27.5	1.99	.605
17 Nov	0910	71.7	6.26	1.16	26.0	.527	.160
20 Nov	1000	144.0	6.69	1.05	28.7	.461	.140
21 Nov	1630	175	9.53	1.00	32.9	.545	.166
24 Nov	0900	239.5	5.06	1.18	30.5	.370	.1125
26 Nov	1430	293	3.76	1.09	28.3	.273	.0830
28 Nov	0900	335.5	2.93	1.23	27.7	.245	.07[illegible]
29 Nov	1300	363.5	3.19	1.06	27.9	.228	.0693
1 Dec	0830	407	2.55	1.12	28.0	.192	.058[illegible]
2 Dec	0800	430.5	2.37	1.21	28.3	.191	.0581
4 Dec	1445	485.3	2.64	1.00	32.3	.154	.0469
5 Dec	1630	511	1.87	1.00	27.9	.126	.0383
5 Dec	1650	511.3	2.00	1.00	26.9	.140	.0425
5 Dec 1952 Shut off until July 10, 1953							
10 July 1953	1800	511.3	2.8	.79	27.0	.150	.0456
11 July	1530	533	1.9	.80	27.6	.101	.03[illegible]
12 July	1340	555	1.5	.79	28.3	.0766	.0233
13 July	0800	573	1.33	.79	26.0	.0739	.022[illegible]
14 July	0900	598	1.66	.79	29	.0827	.0252
15 July	1445	628	1.53	.85	29.2	.0815	.02[illegible]
16 July	0845	646	1.67	.85	28.5	.0911	.027[illegible]
17 July	0930	671	1.53	.85	28.1	.0846	.025[illegible]
20 July	0800	741	1.40	.89	27.4	.0832	.025[illegible]
21 July	0930	767	1.46	.88	28.7	.0819	.024[illegible]
22 July	0900	790	1.36	.89	28.2	.0785	.02[illegible]
23 July	0915	814	1.50	.88	29.9	.0[illegible]	.02[illegible]
24 July	0900	838	1.40	.89	32.2	.0708	.0[illegible]
27 July	0930	911	1.07	.88	36.3	.0475	[illegible]
28 July	0930	945	1.60	.88	33.4	.0771	[illegible]
29 July	1000	969	1.60	.88	35.3	[illegible]	[illegible]
30 July	0900	992	1.50	.88	32.3	[illegible]	[illegible]
31 July	1000	1007	1.60	.86	35.8	.0703	.02[illegible]
3 Aug	0930	1079	1.12	.98	31.7	.0633	.01[illegible]
4 Aug	1000	1103	1.20	.98	35.6	.060[illegible]	.01[illegible]

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
5 Aug	0900	1126	1.05	.95	33.4	.0546	.0166
6 Aug	0930	1151	1.13	.93	34.4	.0558	.0170
7 Aug	0930	1175	.95	.92	29.9	.0535	.0163
10 Aug	0930	1247	1.10	.90	38.0	.0491	.0149
11 Aug	0930	1271	.90	.91	35.5	.0434	.0132
12 Aug	1000	1295	.95	.92	37.7	.0437	.0133
13 Aug	0930	1319	.90	.91	35.6	.0434	.0132
14 Aug	0900	1342	.85	.91	35.9	.0406	.0123
17 Aug	0900	1414	.80	.91	34.5	.0398	.0121
18 Aug	1400	1443	.85	.89	38.0	.0375	.0114
19 Aug	0930	1463	.80	.91	37.8	.0363	.0110
20 Aug	0900	1486	.725	.95	34.2	.0380	.0115
21 Aug	0900	1510	.725	.93	35.1	.0362	.0110
24 Aug	1000	1583	.70	.91	35.5	.0338	.0103
25 Aug	0830	1606	.70	.91	35.6	.0337	.0102
26 Aug	0900	1630	.70	.91	36.7	.0360	.0109
27 Aug	0930	1654	.70	.92	36.7	.0331	.0101
28 Aug	0900	1678	.68	.90	35.4	.0345	.0105
31 Aug	1230	1754	.70	.93	33.0	.0360	.0109
2 Sept	0930	1799	.55	.95	33.0	.0298	.00906
3 Sept	0900	1822	.525	.98	30.5	.0318	.00968
4 Sept	0900	1846	.50	.96	29.9	.0302	.00918
8 Sept	0900	1942	.54	.88	29.4	.0305	.00928
9 Sept	0900	1966	.50	.91	29.3	.0293	.00891
10 Sept	0900	1990	.50	.93	28.4	.0308	.00937
11 Sept	0900	2014	.60	.90	35.8	.0284	.00863
16 Sept	1145	2137	.48	.93	28.1	.0299	.00910
18 Sept	1000	2183	.446	.95	27.6	.0289	.00879
21 Sept	0900	2254	.444	1.01	28.5	.0295	.00896
22 Sept	0900	2278	.389	1.01	27.3	.0270	.00820
23 Sept	0930	2303	.422	1.01	28.6	.0279	.00848
24 Sept	0930	2327	.422	1.01	28.6	.0279	.00848
25 Sept	0930	2351	.400	1.01	27.5	.0275	.00835
28 Sept	0820	2421	.461	1.04	30.8	.0293	.00890
29 Sept	0820	2445	.378	1.02	26.5	.0274	.00832
30 Sept	1330	2475	.411	1.01	27.5	.0284	.00862
1 Oct	Acid plus chlorine treatment begins						
2 Oct	1215	2521	.517	1.00	31.0	.0314	.00954
2 Oct	2200	2531	.665	1.01	27.8	.0455	.0138
	Discontinued						

Table 11. Group IV, Permeameter Data

Well G-1, Sample No. 14

Depth 141 Feet

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
	Start of third run - water de-aerated						
28 June 1954	1000	0	208	.88	18.5	24.5	1.00
29 June	0900	23.0	48	.89	4.0	18.9	.771
30 June	0830	46	300	.90	28.4	16.8	.685
2 July	0920	95	143	.80	27.3	7.42	.303
	1712	103	114	.80	25.1	6.43	.262
5 July	1600	174	92	.85	26.0	5.32	.217
5 July	1625	174.4	90	.85	25.4	5.33	.217
6 July	0900	191	89	.85	30.5	4.38	.179
7 July	1000	216	58	.81	23.9	3.98	.142
8 July	1655	247	42.6	.79	25.8	2.31	.0942
9 July	1710	271	36	.80	24.2	2.11	.086
11 July	0900	311	18	.79	24.5	1.03	.042
12 July	0900	335	15.5	.85	25.0	.933	.038
14 July	1030	384	9.2	.83	24.2	.558	.023
15 July	1645	415	11.9	.70	25.2	.585	.024
16 July	1430	437	11.9	.71	26.2	.572	.023
17 July	1430	461	11.2	.74	25.6	.573	.023
19 July	1650	511	7.18	.74	23	.408	.017
20 July	1015	528	6.0	.79	23	.365	.0149
21 July	1615	558	6.2	.81	25.3	.351	.0143
22 July	0945	576	6.8	.84	26.8	.378	.0154
25 July	1700	655	5.7	.81	26.5	.309	.0126
26 July	1700	679	21	.80	27.3		
28 July	1330	723	5.65	.77	26.5	.291	.0119
29 July	0900	743	6.50	.83	27.6	.346	.0141
30 July	1630	775	5.90	.75	25.5	.307	.0125
3 Aug	1430	868	2.80	.85	26.2	.161	.0066
4 Aug	0930	888	2.70	.88	27.5	.153	.0062
5 Aug	0830	910	2.50	.89	25.8	.153	.0062
9 Aug	1330	1036	2.06	.89	23.6	.137	.0056
11 Aug	1430	1060	1.93	.90	23.6	.130	.0053
13 Aug	1715	1111	1.90	.89	23.6	.129	.0053
16 Aug	0900	1175	2.19	.91	22.4	.157	.0064
17 Aug	0800	1198	7.47	.96	20.3	.625	.0255
18 Aug	0900	1223	7.27	.96	20.3	.608	.0248
22 Aug	2100	1331	2.00	.86	22.9	.133	.0054
24 Aug	2200	1380	1.67	.91	26.8	.100	.0041

Table 12. Group III, Permeameter Data

Well G-1, Sample No. 27

Depth 179 Feet.

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
7 Oct 1952	0948	0	189	.89	22.0	14.0	1.000
7 Oct	0954	0.1	191	.89	22.0	14.1	1.010
7 Oct	1000	0.2	186	.89	22.0	13.8	.985
7 Oct	Outage 9.7 hours						
7 Oct	1700	12	183	.89	20.9	14.2	1.015
8 Oct	1030	20	112	.89	24.6	7.41	.530
8 Oct	1630	26	89.5	.89	24.6	5.91	.422
9 Oct	1630	50	76.7	.90	24.5	5.15	.368
10 Oct	Outage 4.5 hours						
10 Oct	1700	65	92.5	.90	31.8	4.79	.342
11 Oct	Outage 10 hours est.						
11 Oct	1300	75	60	.92			
12 Oct	Outage 10 hours est.						
13 Oct	1645	116	58	.95	26.2	3.85	.275
14 Oct	1645	140	51	.95	25.0	3.55	.254
16 Oct	0900	157	36	.99	25.7	2.54	.181
17 Oct	0900	181	39.8	.98	25.4	2.81	.201
20 Oct	0930	253	29.4	.99	23.9	2.23	.159
21 Oct	0848	276	32.5	.99	24.2	2.44	.174
22 Oct	0900	301	35.0	.975	24.7	2.53	.181
23 Oct	0815	324	34.6	1.00	25.8	2.45	.175
24 Oct	0915	349	30.8	.99	25.5	2.19	.1565
27 Oct	0930	421	26.7	1.00	24.8	1.97	.141
28 Oct	0912	445	25.6	.975	25.0	1.825	.305
29 Oct	0900	469	18.6	.970	25.5	1.30	.0930
30 Oct	1000	494	38.5	.970	25.7	2.66	.190
31 Oct	0915	517	38.6	1.00	25.4	2.78	.198
5 Nov	1120	639	33.2	.89	27.7	1.95	.139
6 Nov	1525	667	36.3	.89	27.3	2.17	.155
7 Nov	1630	692	48.0	.90	32.9	2.40	.172
	3 Hour outage						
11 Nov	0820	777	33.8	1.00	30.3	2.04	.146
13 Nov	0845	825	20.0	1.03	25.0	1.51	.103
	2 hours outage						
14 Nov	1500	854	25.8	1.015	26.9	1.78	.127
17 Nov	0910	920	22.2	1.09	25.5	1.74	.124
20 Nov	1000	993	20.7	1.00	27.5	1.38	.0985
21 Nov	1630	1023	36.3	.95	31.1	2.03	.145
24 Nov	0900	1088	28.2	1.10	29.9	1.90	.136
26 Nov	1430	1141	22.7	1.03	27.1	1.58	.113
28 Nov	0900	1184	17.7	1.12	26.5	1.37	.0978

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
29 Nov	1300	1212	19.5	1.03	27.1	1.36	.0970
1 Dec	Changed to acid plus chlorine treatment						
1 Dec	0830	1255	16.45	1.00	26.4	1.14	.0815
2 Dec	0800	1279	46.7	1.09	26.8	3.48	.248
4 Dec	1445	1333	4.52	1.00	4.7	1.76	.126
5 Dec	1630	1359	3.32	1.00	3.2	1.90	.136
5 Dec	1650	1359	65.6	1.00	23.3	5.16	.369
5 Dec	1700 Shut off until Sept. 24, 1953						
24 Sept 1953	Start of Second Run - No water treatment						
24 Sept	1400	1360	110	1.01	26.0	7.75	.554
25 Sept	1430	1385	59.7	.96	26.4	3.97	.284
28 Sept	0830	1451	37.5	1.04	31.3	2.28	.163
29 Sept	0820	1475	29.2	1.01	26.2	2.06	.147
30 Sept	0810	1499	27.0	1.04	26.8	1.91	.136
1 Oct	0940	1524	25.5	1.02	26.7	1.78	.127
2 Oct	1215	1550	33.3	.96	30.2	1.87	.134
5 Oct	1400	1624	24.0	.77	24.5	1.38	.0986
6 Oct	0830	1643	27.3	.88	25.9	1.70	.122
7 Oct	0820	1666	21.4	.91	25.6	1.39	.0993
8 Oct	0845	1692	18.2	.95	26.6	1.19	.0850
9 Oct	0845	1715	17.4	.98	26.9	1.16	.0830
12 Oct	0845	1787	10.4	.98	27.6	.675	.0482
13 Oct	0815	1810	8.3	1.04	26.8	.589	.0421
14 Oct	0830	1835	7.8	1.04	26.9	.551	.0394
15 Oct	0845	1859	5.8	1.05	27.0	.412	.0294
16 Oct	0830	1883	4.9	1.04	26.8	.348	.0249
19 Oct	0845	1955	2.5	1.06	25.8	.188	.0134
20 Oct	0830	1979	3.9	1.04	31.4	.236	.0169
21 Oct	1200	2006	3.2	1.02	28.2	.212	.0151
22 Oct	1200	2030	2.3	1.02	25.4	.169	.0121
23 Oct	1500	2053	2.1	1.02	23	.170	.0121
26 Oct	0830	2123	4.3	.98	28.5	.271	.0194
27 Oct	0800	2146	4.0	.98	28.2	.254	.0181
28 Oct	1130	2174	4.1	.91	27.8	.245	.0175
30 Oct	1200	2222	8.9	.93	27.4	.533	.0381
	Outage 62 hours						
5 Nov	0900	2291	7.3	1.01	26.5	.508	.0363
6 Nov	1130	2318	6.4	1.04	27.4	.444	.0317
9 Nov	1630	2395	7.9	.90	27.3	.476	.0340
10 Nov	0830	2411	5.6	.95	26.8	.364	.0260
	Outage 170 hours						
18 Nov	1145	2436	29.0	1.05	33.1	1.68	.120
19 Nov	0830	2457	19.6	1.06	33.7	1.12	.080
20 Nov	1100	2483	13.1	1.05	31.2	.805	.0575
23 Nov	0930	2554	5.1	1.06	26.6	.272	.0194
24 Nov	1100	2579	5.4	1.02	26.8	[illegible]	.0193
25 Nov	1440	2607	6.1	.92	28.5	.361	.0258

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
27 Nov	1130	2652	8.0	.93	29.1	.468	.0334
30 Nov	1100	2723	7.7	.93	26.8	.488	.0348
1 Dec	1200	2748	11.7	.96	30.4	.676	.0483
2 Dec	1200	2772	11.0	1.01	31.4	.647	.0462
3 Dec	1600	2800	7.3	1.00	28.1	.476	.0340
4 Dec	0930	2818	6.5	1.02	29.4	.412	.0244
7 Dec	0830	2889	5.32	1.06	31.3	.350	.0250
8 Dec	1030	2915	4.93	1.06	31.1	.326	.0233
9 Dec	0830	2937	4.83	1.06	30.6	.325	.0232
10 Dec	1200	2964	4.70	.96	30.1	.292	.0208
11 Dec	0830	2985	7.04	.93	34.1	.373	.0266
14 Dec	1100	3059	6.57	.96	30.0	.383	.0273
15 Dec	1230	3072	5.48	.93	30.0	.311	.0222
16 Dec	1200	3108	4.93	.95	30.1	.285	.0203
17 Dec	1200	3132	5.07	.93	33.1	.261	.0186
18 Dec	1200	3156	5.53	.96	32.7	.297	.0212
4 Jan 1954	1200	3564	3.73	1.02	32.4	.215	.0154
5 Jan	1200	3588	3.60	1.01	32.1	.207	.0148
6 Jan	1100	3611	3.57	.98	33.1	.193	.0138
	Discontinued until June 17, 1954						
	Start of Third Run - Water De-aerated						
17 June 1954	1600	3611	44.4	.90	27.8	2.62	.187
	1630	3611.5	39.3	.90	25.1	2.58	.184
18 June	0930	3628	26.3	.95	27.2	1.68	.129
	1230	3631	28.0	.95	26.0	1.87	.134
19 June	1220	3655	27.7	.90	26.8	1.70	.121
21 June	1100	3702	16.3	.90	26.7	1.01	.0721
22 June	1330	3728	14.6	.95	25.7	.986	.0704
23 June	0845	3748	14.2	.98	26.2	.953	.0680
24 June	1410	3777	11.5	.90	26.5	.714	.0510
25 June	0830	3795	14.5	.93	34.5	.716	.0511
27 June	1345	3849	12.1	.88	35.3	.553	.0395
29 June	0900	3892	6.67	.93	28.3	.401	.0286
30 June	0830	3915	6.70	.93	30.2	.377	.0269
2 July	0930	3965	4.60	.90	30.2	.251	.0179
5 July	1600	4032	2.50	.85	26.0	.150	.0107
6 July	0830	4059	2.30	.91	25.1	.126	.0090
7 July	1015	4085	3.40	.88	24.3	.225	.0160
9 July	1700	4140	3.40	.79	24.5	.201	.0144
11 July	1600	4187	5.20	.79	25	.300	.0214
12 July	0900	4204	2.91	.90	24.9	.192	.0137
14 July-	1030	4253	1.81	.84	24.6	.113	.00807

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
16 July	1430	4306	3.80	.74	26.2	.196	.0140
17 July	1430	4329	4.85	.75	25.7	.258	.0184
19 July	1630	4380	3.00	.77	22.8	.185	.0132
20 July	1030	4397	5.30	.77	38.7	.192	.0137
22 July	0945	4445	2.60	.85	26.9	.150	.0107
25 July	1700	4524	2.18	.85	26.1	.130	.00928
29 July	0900	4612	3.20	.85	27.7	.179	.0128
30 July	1645	4644	3.20	.75	26.9	.163	.0116
3 Aug	1430	4738	1.60	.85	26.0	.0957	.00683
4 Aug	0930	4757	1.10	.88	27.5	.0644	.00460
5 Aug	0830	4780	1.00	.88	25.3	.0637	.00455
9 Aug	1330	4880	0.87	.90	23.9	.0598	.00427
11 Aug	1430	4929	.90	.91	23.7	.0631	.00451
13 Aug	1715	4980	.90	.89	23.5	.0624	.00446
16 Aug	0900	5044	.94	.93	23.0	.0695	.00496
17 Aug	0800	5091	2.07	.96	20.8	.175	.0125
		5116	2.40	.96	20.6	.205	.0146
22 Aug	2100	5224	.87	.86	23.3	.0587	.00419
24 Aug	2200	5273	.80	.90	26.8	.0440	.00350

Table 13. Group II, Permeameter Data
Well G-1, Sample No. 33,
Depth 194 Feet.

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_0
26 Sept 1952	0836	0	Started				
26 Sept	0845	0.15	119	.96	25.0	8.10	1.000
26 Sept	1136	2.85	121	.96	25.0	8.23	1.017
26 Sept	1630	7.75	112	.96	25.0	7.60	.940
28 - 29 Sept		Outage 10 hours est.					
29 Sept	1630	69.9	116	.90	25.0	7.38	.910
30 Sept	1645	93	83	.90	26.0	5.08	.626
1 Oct	1645	109	54	.90	25.0	3.44	.425
3 Oct	0900	158	33.5	.96	28.6	2.00	.247
6 Oct	1700	238	29	.90	26.0	1.77	.219
7 Oct	Outage 4.25 hours						
7 Oct	1700	258	76.0	.89	26.0	4.60	.569
8 Oct	1000	275	46.0	.89	27.3	2.65	.328
8 Oct	1615	281	44.5	.89	27.3	2.57	.317
8 - 10 Oct. - Outage, 2 days							
10 Oct	1700	282	268	.90	23.0	18.6	2.30
11 Oct	1300	292	136				
	Outage 10 hrs. est.						
13 Oct	1645	343	55	.95	27.0	3.43	.423
14 Oct	1645	367	65	.95	24.7	4.43	.546
15 Oct	0830	changed head to 10 cm.Hg					
16 Oct	0900	408	20.6	.99	11.5	3.14	.388
16 Oct	1000	changed back to full head					
17 Oct	0900	432	50	.98	23.8	3.65	.450
20 Oct	0915	504	39.3	.99	23.2	2.97	.367
21 Oct	0845	527	40.0	.99	24.2	2.90	.358
22 Oct	0848	552	37.1	.98	24.3	2.64	.326
23 Oct	0815	575	38.6	1.00	26.6	2.57	.318
24 Oct	0915	600	33.8	.99	25.4	2.33	.288
27 Oct	0930	672	28.8	1.00	25.9	1.97	.243
28 Oct	0912	696	25.8	.975	24.1	1.84	.227
29 Oct	0900	720	26.0	.970	24.8	1.80	.222
30 Oct	1000	745	25.4	.970	26.8	1.63	.201
31 Oct	0915	768	22.4	1.00	25.9	1.53	.189
	Outage 22 hours						
5 Nov	1120	868	30.0	.89	26.9	1.75	.216
	Outage 1.5 hours						
6 Nov	1525	896	38.3	.89	27.9	2.16	.267
	Outage 6 hours						
7 Nov	1630	914	56.5	.90	33.8	2.66	.328
	Outage 3 hours						
11 Nov	0820	999	24.6	1.00	29.0	1.50	.185

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
13 Nov	0840	1047	62.7	1.03	25.8	4.43	.547
	Outage 2 hours						
14 Nov	1500	1075	18.2	1.015	12.3	2.66	.328
17 Nov	0910	1141	17.8	1.09	13.6	2.53	.312
20 Nov	1000	1214	20.1	1.00	15.5	2.30	.284
21 Nov	1630	1245	19.3	.95	15.9	2.06	.254
24 Nov	0900	1309	13.4	1.10	14.5	1.80	.222
24 Nov	0950	1310	Raised pressure to maximum				
26 Nov	1430	1363	42.7	1.03	26.6	2.93	.362
28 Nov	0900	1405	39.3	1.12	27.3	2.86	.353
29 Nov	1300	1433	39.0	1.03	27.7	2.57	.317
1 Dec	changed to acid plus chlorine treatment						
1 Dec	0830	1477	42.7	1.00	26.6	2.84	.351
2 Dec	0800	1500	73.0	1.09	26.8	5.26	.650
4 Dec	1445	1555	3.44	1.00	0.9	6.76	.835
5 Dec	1630	1581	1.92	1.00	1.1	3.09	.382
5 Dec	1650	1581	99.0	1.00	22.7	7.72	.953
5 Dec	1700	Shut off					

Table 14. Group III, Permeameter Data
Well G-2, Sample No. 33,
Depth 190 Feet.

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm. Hg)	Permeability (ft/day)	P/P_o
16 Oct 1952	1145	C	42.5	.99	26.1	[illegible]	1.000
16 Oct	1148	0.05	39.6	.99	26.1	2.83	.930
16 Oct	1156	.15	39.2	.99	26.1	2.80	.921
16 Oct	1356	2.15	35.0	.99	26.1	2.50	.822
16 Oct	1406	Outage 1.5 hours					
16 Oct	1536						
17 Oct	0900	19.75	26.0	.98	25.5	1.88	.618
20 Oct	0930	92.25	12.8	.99	23.9	1.00	.329
21 Oct	0900	115.75	14.4	.99	24.5	1.10	.362
22 Oct	0900	132.75	12.8	.975	24.9	0.946	.311
23 Oct	0815	163.0	12.3	1.00	26.2	0.885	.291
24 Oct	0930	188	10.5	.99	25.5	.768	.252
27 Oct	0930	260	14.0	1.00	25.0	1.057	.348
28 Oct	0912	283	16.4	.975	26.7	1.13	.372
29 Oct	0900	307	14.2	.970	25.6	1.01	.332
30 Oct	1000	332	14.3	.970	25.9	1.01	.332
31 Oct	0915	356	14.3	1.00	25.6	1.05	.346
5 Nov	1130	478	14.3	.89	28.0	.856	.282
6 Nov	1530	506	15.1	.89	27.8	.910	.299
7 Nov	1630	531	19.5	.90	32.6	1.013	.334
	Outage 3 hours						
11 Nov	0830	616	15.0	1.00	30.5	.928	.305
13 Nov	0845	664	9.8	1.03	25.1	.757	.249
	Outage 2 hours						
14 Nov	1500	692	12.5	1.015	27.1	.883	.290
17 Nov	0910	759	11.0	1.09	25.6	.883	.290
20 Nov	1000	831	11.2	1.00	27.7	.763	.251
21 Nov	1630	862	16.65	.95	31.4	.950	.312
24 Nov	0900	926	12.7	1.10	30.1	.875	.288
26 Nov	1430	980	13.5	1.03	27.4	.956	.315
28 Nov	0900	1022	11.9	1.12	26.7	.940	.309
29 Nov	1300	1040	13.4	1.03	27.0	.964	.317
	Changed to acid plus chlorine treatment						
1 Dec	0900	1094	13.7	1.00	26.7	.967	.318
2 Dec	0900	1117	20.0	1.09	26.9	1.53	.504
4 Dec	1445	1172	35.5	1.00	21.3	3.14	1.032
5 Dec	1630	1198.3	6.9	1.00	6.2	2.10	.691
5 Dec	1650	1198.6	38.8	1.00	25.3	2.89	.952
5 Dec	1700	Shut off until September 24, 1953					
24 Sept 1953 - Start of second run - no water treatment							
24 Sept	1400	1198.6	65.5	1.01	26.4	4.72	1.55
25 Sept	1430	1223	45.6	.96	26.4	3.12	1.025

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
28 Sept	0830	1289	27.2	1.04	31.4	1.69	.556
29 Sept	0820	1313	22.7	1.01	26.6	1.62	.553
30 Sept	0810	1337	20.4	1.04	26.6	1.50	.493
1 Oct	0940	1363	19.2	1.02	26.9	1.37	.451
2 Oct	1215	1389	27.3	.96	29.7	1.66	.546
5 Oct	1400	1463	33.8	.77	27.5	1.78	.585
6 Oct	0830	1482	24.3	.88	26.2	1.54	.507
7 Oct	0820	1505	17.5	.91	25.9	1.16	.382
8 Oct	0845	1531	13.6	.95	29.5	.824	.271
9 Oct	0845	1554	11.7	.98	27.1	.797	.262
12 Oct	0845	1626	9.1	.98	27.6	.609	.200
13 Oct	0815	1649	7.6	1.04	26.9	.553	.182
14 Oct	0830	1674	7.0	1.04	27.2	.504	.166
15 Oct	0845	1698	5.7	1.05	27.1	.416	.137
16 Oct	0830	1722	5.2	1.04	27.0	.377	.124
19 Oct	0845	1794	2.9	1.06	26.0	.223	.0734
20 Oct	0830	1818	3.8	1.04	31.4	.237	.0780
21 Oct	1200	1845	3.1	1.02	28.2	.211	.0695
22 Oct	1200	1869	2.3	1.02	25.4	.174	.0572
23 Oct	1500	1892	2.2	1.02	22.4	.189	.0622
26 Oct	0830	1962	2.9	.98	28.5	.188	.0618
27 Oct	0800	1985	3.0	.98	28.3	.196	.0645
28 Oct	1130	2013	3.6	.91	28.3	.218	.0718
30 Oct	1200	2061	3.2	.93	27.4	.204	.0671
	Outage 62 hours						
5 Nov	0900	2130	2.8	1.01	26.6	.200	.0658
6 Nov	1130	2157	2.6	1.04	28.2	.181	.0595
9 Nov	1630	2234	3.7	.90	27.6	.227	.0747
10 Nov	0830	2250	3.1	.95	27.4	.203	.0669
	Outage 170 hours						
18 Nov	1145	2275	1.57	1.05	33.4	.0932	.0306
19 Nov	0830	2296	3.4	1.06	33.8	.201	.0661
20 Nov	1100	2322	2.8	1.05	31.3	.177	.0582
23 Nov	0930	2393	1.7	1.06	26.7	.127	.0418
24 Nov	1100	2418	1.9	1.02	27.0	.135	.0445
25 Nov	1440	2446	3.1	.92	28.6	.188	.0619
27 Nov	1130	2491	4.2	.93	29.2	.252	.0830
30 Nov	1100	2562	3.2	.93	27.2	.206	.0678
1 Dec	1200	2587	3.7	.96	30.9	.216	.0711
2 Dec	1200	2611	3.3	1.01	31.4	.200	.0658
3 Dec	1600	2639	2.6	1.00	28.1	.174	.0572
4 Dec	0930	2657	2.6	1.02	29.2	.171	.0563
7 Dec	0830	2728	2.31	1.06	31.2	.148	.0487
8 Dec	1030	2754	2.13	1.06	31.1	.137	.0451
9 Dec	0830	2776	2.30	1.06	30.8	.149	.0490
10 Dec	1200	2803	2.47	.96	30.3	.147	.0483
11 Dec		2824	3.35	.93	34.0	.173	.0569
14 Dec	1100	2898	2.67	.96	30.3	.159	.0523
15 Dec	1230	2924	2.44	.93	30.2	.141	.0463
16 Dec	1200	2947	2.30	.95	30.0	.137	.0451
17 Dec	1200	2971	2.40	.93	33.0	.127	.0417
18 Dec	1200	2995	2.83	.96	32.9	.156	.0513

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
4 Jan 1954	1200	3403	2.57	1.02	32.3	.153	.0503
5 Jan	1200	3427	2.33	1.01	32.0	.139	.0457
6 Jan	1100	3450	2.23	.98	33.2	.124	.0408
	Discontinued until June 17, 1954						
	Start of third run - water de-aerated						
17 June	1600	3450	9.3	.90	27.7	.571	.188
17 June	1630	3450.5	2.0	.90	25.2	.807	.265
18 June	0930	3467	8.28	.95	27.4	.541	.178
18 June	1230	3470	9.20	.95	26.0	.633	.208
19 June	1220	3494	10.2	.89	26.9	.635	.209
21 June	1100	3541	15.25	.90	26.7	.971	.319
22 June	1330	3567	5.73	.91	25.8	.381	.125
23 June	0845	3587	5.00	.93	26.0	.337	.111
24 June	1410	3616	4.90	.88	26.5	.307	.101
25 June	0830	3634	5.70	.91	34.4	.285	.0937
27 June	1345	3688	4.73	.91	35.4	.230	.0756
29 June	0900	3731	3.07	.90	28.1	.185	.0608
30 June	0830	3754	3.00	.90	29.9	.170	.0559
2 July	0930	3804	2.40	.90	30.3	.134	.0441
5 July	1600	3882	2.00	.83	26.1	.120	.0395
6 July	0830	3895	1.70	.89	25.3	.113	.0372
7 July	1015	3924	2.10	.83	24.2	.136	.0447
9 July	1700	3979	2.20	.81	24.4	.138	.0454
11 July	1600	4026	2.80	.79	25	.167	.0549
12 July	0900	4043	1.82	.86	24.9	.118	.0388
14 July	1030	4092	1.37	.84	24.7	.0877	.0288
16 July	1430	4145	2.27	.75	26.4	.121	.0398
17 July	1430	4168	2.95	.80	25.8	.172	.0566
19 July	1650	4219	1.92	.77	23.0	.121	.0398
20 July	1030	4236	3.10	.79	38.7	.119	.0341
22 July	0945	4284	1.50	.85	27.0	.0890	.0293
25 July	1700	4363	1.36	.85	26.4	.0826	.0272
29 July	0900	4451	2.00	.85	27.7	.116	.0382
30 July	1645	4483	1.80	.80	27.0	.101	.0332
3 Aug	1430	4577	1.40	.86	26.2	.0866	.0285
4 Aug	0930	4596	.90	.89	27.4	.0550	.0181
5 Aug	0830	4619	.80	.90	25.2	.0539	.0177
9 Aug	1330	4719	.75	.91	23.9	.0524	.0172
11 Aug	1430	4768	.73	.91	23.8	.0525	.0173
13 Aug	1715	4819	.67	.90	23.5	.0484	.0159
16 Aug	0900	4883	.75	.93	22.6	.0582	.0191
17 Aug	0800	4930	1.07	.98	20.4	.0967	.0318
22 Aug	2100	4955	1.07	.99	20.9	.0955	.0314
24 Aug	2200	5063	.80	.86	23.1	.0562	.0185

Table 15. Group IV, Permeameter Data
Well G-4, Sample No. 25
Depth 219 Feet.

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
Start of third run - water de-aerated and filtered							
19 July 1954	1120	0	84	.77	19.5	8.30	1.00
19 July	1650	5.5	117	.74	23.0	7.10	.855
20 July	1015	22.9	81.3	.77	23.3	5.06	.610
21 July	1615	53.0	54.2	.79	25.3	3.19	.385
22 July	0945	70	41.7	.86	26.8	2.52	.304
25 July	1700	150	20.0	.81	26.6	1.15	.139
28 July	1330	219	13.5	.74	26.5	.710	.0855
29 July	0900	238	14.0	.82	27.6	.784	.0945
30 July	1630	269	9.8	.73	25.8	.523	.0631
3 Aug	1430	363	3.3	.85	26.2	.202	.0244
4 Aug	0930	383	3.4	.88	27.5	.205	.0247
5 Aug	0830	405	3.0	.89	25.7	.196	.0236
9 Aug	1330	506	2.27	.89	24.3	.157	.0189
11 Aug	1430	555	2.23	.89	23.9	.157	.0189
13 Aug	1715	602	2.00	.89	23.5	.143	.0172
16 Aug	0900	670	3.06	.90	22.5	.231	.0279
17 Aug	0800	693	8.40	.94	20.3	.733	.0883
18 Aug	0900	718	8.13	.96	20.6	.713	.0860
22 Aug	2100	826	2.50	.86	23.1	.175	.0211
24 Aug	2200	875	2.27	.91	26.5	.147	.0177

Table 16. Group III, Permeameter Data

Well K, Sample No. 21

Depth 195 Feet.

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
5 Nov 1952	1130	640	11.77	0.89	28.0	.705	.217
6 Nov	1530	668	11.6	0.89	27.5	.708	.218
7 Nov	1630	683	14.1	0.90	32.6	1.012	.312
	Outage 3 hours						
11 Nov	0830	778	10.9	1.00	30.5	.674	.207
13 Nov	0845	826	7.15	1.03	25.0	.554	.1705
	Outage 2 hours						
14 Nov	1500	854	8.33	1.015	27.0	.590	.182
17 Nov	0910	920	6.13	1.09	25.4	.496	.153
20 Nov	1000	993	5.87	1.00	27.6	.400	.123
21 Nov	1630	1024	10.15	.95	31.5	.576	.177
24 Nov	0900	1088	8.26	1.10	29.9	.578	.178
26 Nov	1430	1142	6.26	1.03	27.4	.443	.136
28 Nov	0900	1184	6.06	1.12	26.6	.481	.148
29 Nov	1300	1212	6.56	1.03	27.0	.471	.145
1 Dec	Changed to acid plus chlorine treatment						
1 Dec	0830	1256	6.67	1.00	26.7	.470	.145
2 Dec	0800	1279	11.9	1.09	27.1	.902	.278
4 Dec	1445	1334	17.0	1.00	31.2	1.030	.317
5 Dec	1630	1360	13.5	1.00	26.6	.957	.294
5 Dec	1650	1360.3	13.2	1.00	24.5	1.015	.312
5 Dec	1700 Shut off until Sept. 24, 1953						
24 Sept 1953	Start of second run - no water treatment						
24 Sept	1430	1360.3	19	1.01	25.7	1.41	.434
25 Sept	1430	1384	17	.96	26.6	1.15	.354
28 Sept	0830	1450	15	1.04	31.0	.947	.292
29 Sept	0820	1474	13	1.01	26.4	.935	.288
30 Sept	0810	1498	12.3	1.04	26.8	.898	.276
1 Oct	0940	1524	11.5	1.02	27.0	.818	.252
2 Oct	1215	1550	13.3	.96	30.3	.794	.244
5 Oct	1400	1624	8.67	.77	24.6	.512	.157
6 Oct	0830	1643	6.82	.88	25.4	.445	.137
7 Oct	0820	1666	8.5	.91	25.9	.563	.173
8 Oct	0845	1692	7.5	.95	26.6	.505	.155
9 Oct	0845	1715	7.4	.98	26.8	.510	.157
12 Oct	0845	1787	6.9	.98	27.5	.463	.142
13 Oct	0815	1810	6.4	1.04	26.8	.468	.144
14 Oct	0830	1835	6.1	1.04	28.7	.416	.128
15 Oct	0845	1859	5.5	1.05	26.9	.404	.124
16 Oct	0830	1883	4.9	1.04	26.7	.360	.111
19 Oct	0845	1955	3.2	1.06	25.6	.250	.0769
20 Oct	0830	1979	4.2	1.04	31.2	.364	.112

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
21 Oct	1200	2006	3.3	1.02	28.1	.226	.0695
22 Oct	1200	2030	2.8	1.02	25.1	.212	.0652
23 Oct	1500	2053	2.9	1.02	22.0	.253	.0778
26 Oct	0830	2123	3.4	.98	28.3	.222	.0683
27 Oct	0800	2146	3.5	.98	28.2	.229	.0705
28 Oct	1130	2174	3.5	..91	27.8	.215	.0662
30 Oct	1200	2222	3.5	.93	27.4	.224	.0690
	Outage 62 hours						
5 Nov	0900	2291	3.6	1.01	26.8	.255	.0785
6 Nov	1130	2318	3.7	1.04	27.3	.263	.0810
9 Nov	1630	2395	4.2	.90	27.6	.265	.0815
10 Nov	0830	2411	3.4	.95	26.5	.229	.0705
18 Nov	1145	2436	4.6	1.05	33.3	.273	.0840
19 Nov	0830	2457	4.5	1.06	33.8	.266	.0819
20 Nov	1100	2483	3.7	1.05	31.2	.235	.0723
23 Nov	0930	2554	2.4	1.06	25.8	.186	.0572
24 Nov	1100	2579	2.6	1.02	26.9	.186	.0572
25 Nov	1440	2607	3.4	.92	28.5	.206	.0633
27 Nov	1130	2652	4.1	.93	29.4	.244	.0751
30 Nov	1100	2773	3.2	.93	26.9	.208	.0640
1 Dec	1200	2748	3.8	.96	30.7	.217	.0667
2 Dec	1200	2772	3.7	1.01	31.2	.225	.0692
3 Dec	1600	2800	3.1	1.00	27.9	.209	.0643
4 Dec	0930	2818	3.2	1.02	29.6	.207	.0637
7 Dec	0830	2889	3.17	1.06	31.4	.202	.0622
8 Dec	1030	2915	3.07	1.06	31.1	.197	.0606
9 Dec	0830	2937	3.27	1.06	30.8	.212	.0652
10 Dec	1200	2964	3.37	.96	30.4	.200	.0615
11 Dec	0830	2985	4.00	.93	34.2	.205	.0631
14 Dec	1100	3059	3.50	.96	30.4	.208	.0640
15 Dec	1230	3072	3.08	.93	30.2	.179	.0550
16 Dec	1200	3108	3.00	.95	30.3	.177	.0544
17 Dec	1200	3132	3.13	.93	33.3	.165	.0507
18 Dec	1200	3156	3.50	.96	33.0	.192	.0590
4 Jan 1954	1200	3564	3.60	1.02	32.0	.216	.0665
5 Jan	1200	3588	3.73	1.01	32.5	.218	.0670
6 Jan	1100	3611	3.73	.98	33.2	.207	.0636
17 June	1600	3611	6.3	.90	28.0	.383	.118
	1630	3611.5	8.0	.90	25.2	.537	.165
18 June	0930	3628	19.1	.95	27.3	1.25	.385
18 June	1230	3631	19.6	.89	26.0	1.26	.383
19 June	1220	3655	17.5	.89	26.9	1.09	.335
21 June	1100	3702	10.7	.90	26.7	.680	.209
22 June	1330	3728	9.40	.91	25.7	.628	.193
23 June	0845	3748	8.90	.83	26.0	.599	.184
24 June	1410	3777	7.90	.88	26.3	.498	.153
25 June	0830	3795	9.70	.91	34.3	.484	.149
27 June	1345	3849	8.45	.88	35.4	.396	.122
29 June	0900	3892	5.20	.90	27.8	.317	.0975

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
30 June	0830	3915	5.20	.90	29.8	.296	.0910
2 July	0930	3965	4.20	.90	30.2	.236	.0726
5 July	1600	4043	3.50	.85	26.2	.215	.0661
6 July	0830	4059	3.00	.91	25.1	.205	.0631
7 July	1015	4085	3.20	.88	24.2	.219	.0674
9 July	1700	4140	3.40	.79	25.2	.202	.0621
11 July	1600	4187	4.40	.79	25.5	.256	.0737
14 July	1030	4253	2.73	.86	24.9	.177	.0544
16 July	1430	4306	2.93	.74	26.3	.155	.0477
17 July	1430	4329	3.55	.77	25.9	.198	.0609
19 July	1650	4380	2.42	.77	23.1	.153	.0471
20 July	1030	4397	3.80	.78	38.7	.145	.0446
22 July	0945	4445	2.20	.86	26.4	.134	.0412
25 July	1700	4524	2.00	.84	26.6	.119	.0365
29 July	0900	4612	2.70	.85	27.5	.156	.0480
30 July	1645	4644	2.60	.74	27.1	.134	.0412
3 Aug	1430	4738	1.40	.85	26.0	.0867	.0267
4 Aug	0930	4757	1.40	.88	27.4	.0848	.0261
5 Aug	0830	4780	1.20	.88	25.4	.0791	.0243
9 Aug	1330	4880	1.13	.90	24.1	.0791	.0243
11 Aug	1430	4929	1.07	.90	23.5	.0773	.0238
13 Aug	1715	4980	1.07	.88	23.4	.0754	.0232
16 Aug	0900	5044	1.06	.91	22.3	.0810	.0249
17 Aug	0800	5091	1.70	.96	20.3	.151	.0464
18 Aug	0900	5116	1.73	.94	20.8	.147	.0453
22 Aug	2100	5224	0.97	.86	23.1	.0679	.0209
24 Aug	2200	5273	0.93	.90	27.2	.0584	.0180

Table 17. Group II, Permeameter Data
Well K, Sample No. 35
Depth 296 Feet.

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
23 Sept 1952	1545	0	600	.86	22.5	43.2	1.000
23 Sept	1600	0.25	700	.86	22.5	50.5	1.170
24 Sept	0815	16	116	.95	22.6	9.19	.213
24 Sept	1130	19	89	.82	22.6	6.09	.141
25 Sept	1130	33	44.7	.94	26.5	2.99	.0692
	Outage - 2 hours						
26 Sept	1145	68	30.9	.96	24.5	2.28	.0528
28-29 Sept	Outage - 10 hours est.						
29 Sept	1630	134	274	.90	25.5	18.2	.420
30 Sept	1545	158	161	.90	26.2	10.4	.241
1 Oct	1645	183	105	.95	25.0	7.52	.174
3 Oct	0900	223	62	.96	28.0	4.00	.0926
6 Oct	1700	303	51	.90	26.0	3.33	.0770
7 Oct	Outage - 4.25 hours						
7 Oct	1700	323	187	.89	26.0	12.0	.278
8 Oct	1000	340	125	.89	26.7	7.85	.182
8 Oct	1615	346	129	.89	27.3	7.91	.183
8 - 10 Oct -	2 days outage						
10 Oct	1700	347	234	.90	32.0	12.4	.287
11 Oct	1300	367	125				
12 Oct	Outage 10 hours est.						
13 Oct	1645	408	70	.95	27.0	4.64	.1075
14 Oct	1645	432	57	.95	24.7	4.13	.0957
16 Oct	0900	473	20.8	.99	11.0	3.53	.0818
17 Oct	0900	497	52.7	.98	23.4	4.17	.0965
20 Oct	0915	569	47.2	.99	23.0	3.84	.0891
21 Oct	0845	592	55.0	.99	24.0	4.27	.0990
22 Oct	0848	616	51.0	.98	24.1	3.91	.0905
23 Oct	0875	640	56.8	1.00	26.0	4.11	.0953
24 Oct	0975	663	52.8	.99	25.5	3.86	.0894
27 Oct	0915	735	55.0	1.00	25.9	4.00	.0926
28 Oct	0912	759	46.0	.975	24.2	3.49	.0808
29 Oct	0900	783	47.2	.970	24.5	3.84	.0890
30 Oct	1000	808	45.5	.970	26.7	3.21	.0744
31 Oct	0975	831	47.2	1.00	25.8	3.45	.0800
	Outage 22 hours						
5 Nov	1120	931	48.5	.89	26.5	3.07	.0710
	Outage 1.5 hours						
6 Nov	1525	957	56.0	.89	27.8	3.38	.0782
	Outage 6 hours						

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_0
7 Nov	1630	977	73.4	.90	33.4	3.73	.0863
	Outage 3 hours						
11 Nov	0820	1061	44.4	1.00	28.8	2.90	.0671
13 Nov	0840	1110	176.0	1.03	25.3	13.5	.3125
	Outage 2 hours						
14 Nov	1500	1128	74.7	1.015	13.9	10.3	.238
17 Nov	0910	1204	65.0	1.09	14.7	2.09	.210
20 Nov	1000	1277	60.7	1.00	16.4	6.98	.1615
21 Nov	1630	1308	62.5	0.95	17.7	6.32	.146
24 Nov	0900	1372	51.6	1.10	17.7	6.05	.140
26 Nov	1430	1426	105.0	1.03	26.4	7.72	.179
28 Nov	0900	1468	103.0	1.12	30.7	7.08	.164
29 Nov	1300	1496	102.0	1.03	28.0	7.07	.164
1 Dec	Changed to acid plus chlorine treatment						
1 Dec	0830	1540	89.0	1.00	27.6	6.08	.1405
2 Dec	0800	1563	198.0	1.09	27.1	15.0	.347
4 Dec	1445	1618	5.76	1.00	0.4	27.2	.623
5 Dec	1630	1644	4.75	1.00	0.5	17.9	.415
5 Dec	1650	1644.3	156.0	1.00	24.9	11.8	.273
5 Dec	1700	Shut off					

Table 18. Group I, Permeameter Data
Well K-12, Sample No. 23
Depth 318 Feet.

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
12 Sept 1952	1200	0	173	.98	20.3	15.3	1.000
12 Sept	1400	2.0	160	.98	20.3	14.1	.921
15 Sept	1015	70	8.6	.90	32.0	.442	.0282
16 Sept	0800	92	4.3	.92	26.7	.271	.0177
17 Sept	1100	119	4.8	.91	30.5	.262	.0171
18 Sept	1100	143	4.4	.90	33.0	.219	.0143
19 Sept	0930	165	3.6	.90	26.1	.227	.0148
22 Sept	0900	237	1.45	.88	29.2	.0799	.00521
23 Sept	1130	263	1.2	.86	31.4	.0620	.00405
24 Sept	1130	287	.82	.95	22.2	.0641	.00409
25 Sept	1130	311	.93	.94	27.0	.0592	.00387
	Outage 2 hours						
26 Sept	1145	335	1.02	.96	23.7	.0756	.00494
28 Sept	Outage 10 hours est.						
29 Sept	1630	402	5.8	.90	25.7	.372	.0243
30 Sept	1545	425	2.3	.90	26.5	.143	.00935
1 Oct	1645	450	1.48	.95	25.5	.101	.00660
3 Oct	0900	491	1.60	.96	28.5	.099	.00648
6 Oct	1700	571	1.68	.90	26.5	.104	.00680
7 Oct	Outage 4.25 hours						
8 Oct	1015	608	1.67	.89	27.5	.099	.00648
8 Oct	1630	614	1.32	.89	27.5	.0790	.00516
9 Oct	1700	638	1.28	.90	26.8	.0786	.00515
10 Oct	1700	652	2.33	.90	32.5	.118	.00770
12 Oct	Outage 10 hrs. est.						
13 Oct	1645	724.5	1.40	.95	27.3	.089	.00890
14 Oct	1645	748	1.45	.95	25.5	.099	.00646
16 Oct	0900	788	1.29	.99	26.8	.0872	.00570
17 Oct	0930	813	1.25	.98	26.7	.0840	.00550
20 Oct	0930	885	0.84	.99	23.3	.0653	.00427
21 Oct	0900	908	1.00	.99	27.2	.0665	.00435
21 Oct	1615	916.0	Permeameter reconnected for reverse flow				
21 Oct	1630	914	12.5	.99	27.4	.825	.0540
22 Oct	0900	920	12.0	.975	26.8	.799	.0522
23 Oct	0830	954	11.4	00	27.6	.756	.0495
24 Oct	0930	979	10.9	.990	27.0	.732	.0478
27 Oct	0930	1051	12.5	1.00	27.0	.847	.0554
28 Oct	0912	1074	12.4	.975	27.6	.800	.0523
29 Oct	0900	1098	12.8	.970	26.6	.854	.0558
30 Oct	1000	1123	13.3	.970	27.5	.858	.0560
31 Oct	0915	1147	12.7	1.00	26.5	.880	.0575
5 Nov	1130	1269	14.4	.89	29.1	.807	.0527
6 Nov	1530	1297	13.9	.89	28.7	.811	.0530
7 Nov	1630	1322	16.0	.89	33.2	.785	.0512
	Outage 3 hours						
11 Nov	0830	1407	11.9	1.00	30.9	.70	.0460

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
13 Nov 1952	0845	1455	8.20	1.16	26.1	.667	.0435
	Outage 2 hours						
14 Nov	1500	1483	8.85	1.10	27.9	.656	.0428
17 Nov	0910	1550	6.86	1.16	26.1	.559	.0365
20 Nov	1000	1622	8.18	1.05	28.8	.545	.0356
21 Nov	1630	1653	9.73	1.00	33.0	.540	.0353
24 Nov	0900	1717	7.46	1.18	30.6	.526	.0344
26 Nov	1430	1771	6.86	1.09	28.3	.454	.0296
28 Nov	0900	1813	6.26	1.23	28.6	.492	.0321
29 Nov	1300	1841	6.75	1.06	28.1	.465	.0304
1 Dec	0830	1885	6.55	1.12	28.1	.478	.0312
2 Dec	0800	1908	6.50	1.21	28.5	.505	.0330
4 Dec	1445	1963	8.08	1.00	32.4	.466	.0305
5 Dec	1630	1989	6.60	1.00	28.0	.431	.0282
5 Dec	1650	1989	6.70	1.00	26.9	.456	.0298
5 Dec	1700	Shut off until July 10, 1953					
	Start of second run - continued reversed flow - no water treatment						
10 July 1953	1800	1989.6	7.50	.79	25.5	.425	.0278
11 July	1530	2011	8.40	.76	26.7	.437	.0286
12 July	1340	2033	7.60	.76	26.6	.397	.0260
13 July	0800	2051	7.14	.79	25.3	.408	.0267
14 July	0900	2076	8.24	.79	27.9	.426	.0279
15 July	1445	2106	8.13	.80	28.2	.422	.0276
16 July	0845	2124	8.33	.83	27.6	.458	.0299
17 July	0930	2149	7.67	.83	27.4	.425	.0278
20 July	0800	2219	7.73	.89	26.6	.473	.0309
21 July	0930	2245	8.67	.86	28.2	.484	.0316
22 July	0900	2268	8.72	.86	27.4	.501	.0328
23 July	0915	2293	9.85	.86	29.6	.523	.0342
24 July	0900	2316	9.60	.86	35.9	.421	.0275
27 July	0930	2389	10.5	.89	35.5	.482	.0315
28 July	0930	2423	9.50	.86	33.0	.453	.0296
29 July	1000	2447	9.59	.86	34.4	.438	.0286
30 July	0900	2470	9.30	.86	31.7	.462	.0302
31 July	1000	2485	10.2	.83	34.9	.444	.0290
3 Aug	0930	2557	7.60	.95	31.0	.426	.0279
4 Aug	1000	2581	8.90	.95	35.1	.441	.0288
5 Aug	0900	2604	7.60	.95	32.4	.407	.0266
6 Aug	0930	2629	7.47	.93	33.6	.378	.0246
7 Aug	0930	2653	7.10	.91	29.1	.406	.0265
10 Aug	0930	2725	7.45	.89	37.9	.320	.0209
11 Aug	0930	2749	6.50	.89	34.4	.307	.0201
12 Aug	1000	2773	6.50	.91	36.8	.302	.0197
13 Aug	0930	2797	6.30	.89	34.5	.297	.0194
14 Aug	0900	2820	6.30	.89	34.1	.301	.0196
17 Aug	0900	2892	5.70	.89	33.6	.276	.0180
18 Aug	1400	2921	6.20	.86	37.2	.262	.0171
19 Aug	0930	2941	5.44	.89	36.9	.240	.0157

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
20 Aug	0900	2964	4.70	.93	33.1	.241	.0157
21 Aug	0900	2988	4.60	.91	34.3	.223	.0146
24 Aug	1000	3061	4.80	.89	34.5	.227	.0148
25 Aug	0830	3084	4.10	.89	34.8	.192	.0125
26 Aug	0900	3108	4.10	.89	35.7	.186	.0121
27 Aug	0930	3132	4.00	.89	35.8	.182	.0119
28 Aug	0900	3156	3.40	.89	32.5	.170	.0111
31 Aug	1230	3232	3.57	.91	34.0	.174	.0114
2 Sept	0930	3277	2.25	.93	34.1	.112	.00732
3 Sept	0900	3300	2.05	.95	29.2	.122	.00797
4 Sept	0900	3324	1.75	.93	29.1	.102	.00666
8 Sept	0900	3420	1.78	.89	28.3	.102	.00666
9 Sept	0900	3444	1.38	.89	28.3	.0793	.00518
10 Sept	0900	3468	1.38	.91	27.4	.0837	.00546
11 Sept	0900	3492	1.72	.86	35.2	.0769	.00502
16 Sept	1645	3615	1.50	.91	22.5	.111	.00725
18 Sept	1000	3661	1.13	.91	26.5	.0708	.00463
21 Sept	0900	3732	1.38	.98	27.7	.0893	.00583
22 Sept	0900	3756	1.23	.98	25.8	.0855	.00559
23 Sept	0930	3781	1.35	.98	27.8	.0870	.00569
24 Sept	0930	3805	1.13	.98	27.6	.0733	.00479
25 Sept	0930	3829	.978	.98	26.8	.0662	.00433
28 Sept	0820	3900	1.24	1.01	29.9	.0765	.00500
29 Sept	0820	3924	.80	.98	25.5	.0562	.00367
30 Sept	1330	3953	1.15	.96	26.5	.0762	.00498
1 Oct	1220	Acid plus chlorine treatment begins					
2 Oct	1215	4000	6.02	.96	29.9	.354	.0231
2 Oct	2200	4009	8.81	.95	26.3	.582	.0381
5 Oct	1500	4074	37.4	.77	13.7	3.85	.252
6 Oct	0830	4092	62.5	.89	23.6	4.32	.282
7 Oct	0820	4116	66.0	.92	21.8	5.10	.333
8 Oct	0845	4140	70.0	.95	22.1	5.51	.360
9 Oct	0845	4164	80.0	.98	24.6	5.83	.381
12 Oct	0845	4236	73.8	.98	25.0	5.29	.346
13 Oct	0820	4260	48.7	1.02	20.8	4.37	.286
14 Oct	0830	4284	69.6	1.06	25.8	5.23	.342
15 Oct	0845	4308	56.0	1.08	25.5	4.33	.283
16 Oct	0830	4332	52.0	1.08	25.8	3.98	.260
	Outage 59 hours						
19 Oct	0845	4336	56.0	1.08	24.0	4.35	.284
20 Oct	0830	4369	76.0	1.08	28.4	5.28	.345
21 Oct	1200	4384	43.3	1.04	25.9	3.18	.208
22 Oct	1200	4420	37	1	23.2	2.92	.191
23 Oct	1500	4447	69	1	18.2	6.94	.454
	Outage 48 hours						
26 Oct	0830	4465	40	1.01	26.2	2.82	.184
27 Oct	0800	4488	58	1	27.7	3.83	.250
28 Oct	1130	4516	39	..91	27.4	2.37	.155
29 Oct	0800	4536	33	.96	27.4	2.11	.138
30 Oct	1200	4564	32	1.0	26.4	2.22	.145
	Outage 24 hours						

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day	P/P_o
3 Nov	1200	4636	49	1.05	27.4	3.27	.214
4 Nov	0800	4665	54	1.08	26.0	4.11	.269
	Outage 12 hours						
5 Nov	1700	4677	51	1.06	24.7	4.00	.261
6 Nov	0930	4694	56	1.10	24.4	4.62	.302
9 Nov	1630	4773	52	.95	25.2	3.58	.234
10 Nov	0830	4790	57	.98	27.5	3.72	.243
11 Nov	1130	4817	29.3	.95	28.4	1.79	.117
12 Nov	1230	4842	24.7	1.04	24.7	1.90	.124
13 Nov	1100	4865	31.5	1.08	30.9	2.01	.131
16 Nov	1100	4837	29.0	1.02	29.8	1.81	.118
17 Nov	0800	4956	27.3	1.06	25.9	2.04	.133
18 Nov	1130	4984	29.7	1.10	27.6	2.16	.141
19 Nov	0830	5005	31.3	1.10	31.4	2.00	.131
20 Nov	1100	5031	30.0	1.10	29.9	2.02	.132
23 Nov	0930	5102	34.5	1.10	25.3	2.74	.179
24 Nov	1200	5028	29.0	1.06	25.2	2.23	.146
25 Nov	1440	5155	32.0	.93	28.1	2.01	.131
27 Nov	1130	5200	34.0	.95	28.2	2.09	.137
30 Nov	1100	5271	29.1	.95	24.9	2.03	.133
1 Dec	1200	5284	32.0	1.01	29.2	2.02	.132
2 Dec	1200	5308	26.3	1.04	39.7	1.68	.110
3 Dec	1600	5332	24.7	1.05	26.1	1.82	.119
4 Dec	0930	5356	26.0	1.06	28.3	1.78	.116
7 Dec	0930	5581	28.3	1.10	29.9	1.91	.125
8 Dec	1030	5606	27.7	1.14	29.1	1.99	.130
9 Dec	0830	5628	28.0	1.08	28.9	1.91	.125
10 Dec	1200	5656	28.7	1.01	28.8	1.84	.120
11 Dec	0830	5676	31.7	.98	31.7	1.79	.117
14 Dec	1100	5751	38.3	1.01	28.6	2.48	.162
15 Dec	1230	5776	20.0	.96	28.2	1.24	.0810
4 Jan 1954	1200	6256	18.0	1.02	29.9	1.12	.0732
5 Jan	1200	6280	19.0	1.01	30.9	1.13	.0738
6 Jan	1100	6303	19.8	.98	32.2	1.10	.0719
7 Jan	1200	6328	21.2	.98	32.1	1.18	.0771

Table 19. Group II, Permeameter Data
Well L-1, Sample No. 20,
Depth 124 Feet.

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
23 Sept 1952	1412	0	53.5	.86	29.5	2.94	1.000
23 Sept	1436	0	50.0	.86	29.5	2.75	.935
24 Sept	1130	21	10.8	.95	21.9	.887	.302
25 Sept	1130	45	12.0	.94	26.5	.801	.272
26 Sept	1145	59	9.0	.96	23.9	.681	.232
28 Sept	Outage 10 hours est.						
29 Sept	1630	136	15.0	.90	26.0	.978	.333
30 Sept	1545	159	9.85	.90	26.0	.642	.218
1 Oct	1645	184	6.3	.95	25.0	.451	.153
6 Oct	1700	304	6.2	.90	26.0	.405	.138
7 Oct	Outage 4.25 hours						
8 Oct	1015	341	6.0	.89	27.3	.358	.122
8 Oct	1630	348	6.0	.89	27.3	.358	.122
9 Oct	Outage 1 day, 3.5 hours						
10 Oct	1700	369	27.7	.90	32.0	1.47	.500
12 Oct	Outage 10 hours est.						
13 Oct	1645	430	4.9	.95	27.0	.325	.110
14 Oct	1645	454	4.0	.95	24.7	.290	.0986
16 Oct	0900	495	2.8	.99	23.9	.218	.0741
17 Oct	0930	519	2.95	.98	23.9	.228	.0775
20 Oct	0930	591	3.24	.99	24.1	.243	.0826
21 Oct	0900	615	3.47	.99	27.3	.237	.0806
22 Oct	0915	639	3.43	.98	25.1	.253	.0860
23 Oct	0830	662	3.54	1.00	25.4	.263	.0895
24 Oct	0930	687	3.47	.99	24.1	.269	.0915
27 Oct	0930	757	3.9	1.00	25.9	.284	.0965
28 Oct	0912	781	3.4	.975	24.2	.258	.0878
29 Oct	0900	805	3.8	.970	24.9	.279	.0950
30 Oct	1000	830	3.17	.970	27.0	.215	.0730
31 Oct	0915	853	2.93	1.00	25.6	.210	.0715
	Outage 22 hours						
5 Nov	1130	953	3.77	.89	27.3	.231	.0785
	Outage 1.5 hours						
6 Nov	1530	980	4.73	.89	28.1	.282	.0959
	Outage 6 hours						
7 Nov	1630	999	6.53	.90	31.6	.350	.1190
	Outage 3 hours						
11 Nov	0830	1084	3.46	1.00	29.0	.225	.0765
13 Nov	0845	1132	7.25	1.03	25.0	.563	.1915
	Outage 2 hours						
14 Nov	1500	1160	4.80	1.015	26.0	.353	.1200
17 Nov	0910	1226	3.86	1.09	25.6	.310	.1055

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
20 Nov	1000	1299	4.62	1.00	29.1	.300	.1020
21 Nov	1630	1330	6.20	.95	31.2	.356	.1210
24 Nov	0900	1394	4.26	1.10	28.9	.306	.1040
26 Nov	1430	1448	3.60	1.03	26.5	.264	.0899
28 Nov	0900	1490	3.47	1.12	28.0	.262	.0891
29 Nov	1300	1518	3.75	1.03	28.4	.256	.0870
1 Dec	changed to acid and chlorine treatment						
1 Dec	0830	1562	2.67	1.00	27.5	.183	.0622
2 Dec	0800	1585	4.00	1.09	27.6	.298	.1012
4 Dec	1445	1640	4.96	1.00	31.4	.298	.1012
5 Dec	1630	1666	3.87	1.00	27.2	.268	.0912
5 Dec	1650	1666	3.64	1.00	24.5	.280	.0953
5 Dec	1700	Shut off					

Table 20. Group I, Permeameter Data
Well M-18, Sample No. 23
Depth 290 Feet.

Date	Time of Day	Accumulated Time	Flow (cc/min)	Temp. Correction Factor	Head (cm.Hg)	Permeability (ft/day)	P/P_o
11 Sept 1952	1900	0	24	.95	21.0	2.04	1.000
15 Sept	1030	87	7.2	.90	32.0	.381	.187
16 Sept	0800	109	4.7	.92	28.3	.288	.141
17 Sept	1100	136	5.0	.91	32.0	.268	.131
18 Sept	1100	160	4.8	.90	33.3	.244	.1195
19 Sept	0930	182	4.0	.90	26.0	.261	.128
22 Sept	0900	254	2.4	.88	29.2	.136	.0666
23 Sept	1130	280	2.4	.86	31.5	.123	.0603
24 Sept	1130	304	1.93	.95	24.3	.142	.0696
25 Sept	1130	328	2.16	.94	27.0	.142	.0696
	Outage 2 hours						
26 Sept	1145	352	2.00	.96	25.7	.141	.0690
28 Sept	Outage 10 hours est.						
29 Sept	1630	419	2.22	.90	26.5	.142	.0696
30 Sept-	1545	442	2.05	.90	26.0	.134	.0656
1 Oct	1645	467	1.73	.95	25.5	.122	.0598
3 Oct	0900	508	1.92	.96	28.5	.122	.0598
6 Oct	1700	588	1.57	.90	26.5	.100	.0490
7 Oct	Outage 4.25 hours						
8 Oct	1015	625	1.64	.89	27.7	.099	.0485
8 Oct	1630	631	1.65	.89	27.7	.100	.0490
9 Oct	1700	655	1.53	.90	26.8	.097	.0475
10 Oct	1700	679	2.33	.90	32.5	.122	.0598
12 Oct	Outage 10 hours est.						
13 Oct	1645	741	1.6	.95	27.3	.105	.0515
14 Oct	1645	765	1.4	.95	25.5	.098	.0480
16 Oct	0900	807	1.29	.99	27.3	.0882	.0432
17 Oct	0930	830	1.25	.98	26.0	.0888	.0435
20 Oct	0930	902	.87	.99	25.8	.0629	.0308
21 Oct	0900	925	.94	.99	26.6	.0659	.0323
22 Oct	0915	950	1.03	.98	26.7	.0713	.0349
23 Oct	0830	973	.93	1.00	27.0	.0650	.0318
24 Oct	0930	996	.90	.99	26.8	.0627	.0307
27 Oct	0930	1068	.90	1.00	27.0	.0629	.0308
28 Oct	0912	1091	.80	.975	26.7	.0550	.0270
29 Oct	1045	1117	.90	.97	26.5	.0620	.0304
30 Oct	1000	1140	.75	.97	27.4	.0500	.0245
31 Oct	0915	1164	.76	1.00	26.6	.0543	.0266
5 Nov	1130	1286	.675	.89	29.0	.0391	.0192
6 Nov	1530	1314	.627	.89	28.6	.0368	.0180
7 Nov	1630	1339	.773	.90	33.1	.0396	.0194
	Outage 3 hours						
11 Nov	0820	1424	.407	1.00	30.8	.0249	.0122
11 Nov	1400	1429	Discontinued				